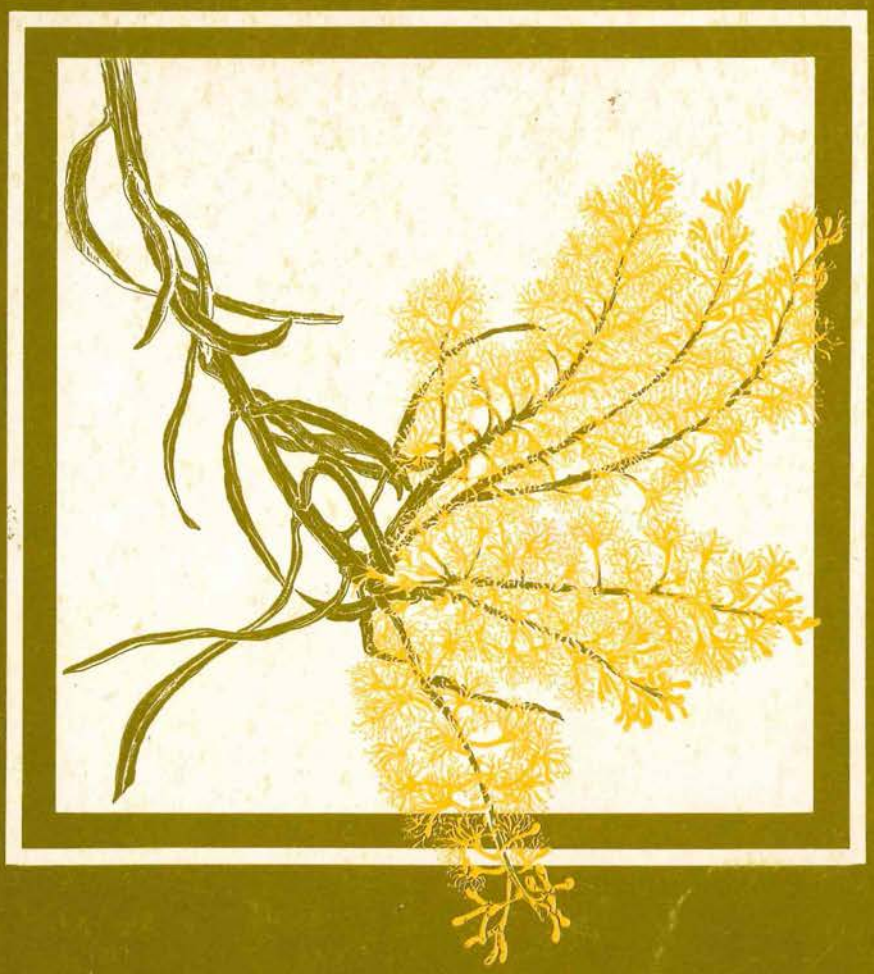

NUYTSIA

Volume 6 · Number 2
1988

WESTERN AUSTRALIAN HERBARIUM

DEPARTMENT OF AGRICULTURE

Contents

ISSN 0085-4417

NUYTSIA

VOLUME 6 NUMBER 2
1988

WESTERN AUSTRALIAN HERBARIUM,
DEPARTMENT OF AGRICULTURE,
SOUTH PERTH, WESTERN AUSTRALIA

CONTENTS

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A revision of Western Australian Thymelaeaceae

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Abstract

Rye, B.L. A revision of Western Australian Thymelaeaceae, Nuytsia 6(2):129-278 (1988). Western Australian Thymelaeaceae are revised and a new infrageneric classification for the genus *Pimelea* is presented. *Thecanthes*, with three Western Australian species, is reinstated as a genus and the remaining 45 Western Australian species recognised here are retained in *Pimelea*. Sect. *Heterantheros* Rye and sect. *Stipostachys* Rye are newly described, the new combination sect. *Macrostegia* (Turcz.) Rye is made and the following new species are described: *P. avonensis* Rye, *P. cracens* Rye, *P. erecta* Rye, *P. graniticola* Rye, *P. halophila* Rye, *P. pendens* Rye and *P. sessilis* Rye. The new combinations *P. drummondii* (Turcz.) Rye, based on *Calyptrostegia drummondii* Turcz., and *P. subvillifera* (Threlfall) Rye, based on *P. octophylla* R. Br. subsp. *subvillifera* Threlfall, are made. Five new subspecies are described and new combinations are made for three subspecies and two varieties.

Contents

Introduction

General. The family Thymelaeaceae is represented in Western Australia by two closely related genera *Pimelea* and *Thecanthes*, the latter reinstated in this revision. The genus *Wikstroemia*, formerly recorded for the state on the basis of *W. indica* C. Meyer by Gardner (1930-31) and Green (1981), is excluded as the closest known collection of this species is from the western side of the Gulf of Carpentaria, Northern Territory. *Wikstroemia* is now assumed not to occur in Western Australia. Two other genera, *Phaleria* and *Arnhemia*, also occur in Northern Territory but have not been recorded in Western Australia. Both are known to occur closer to the Western Australian border than does *Wikstroemia*.

Pimelea and *Thecanthes* are readily distinguished from other members of the family by their stamen number of two or (in *Pimelea*) very rarely one, all other genera having at least four stamens. They belong to subfamily Thymelaeoideae and, in the classification of Domke (1934), are the only members of subtribe Pimeleinae within tribe Gnideae. Both genera are concentrated in Australia, *Pimelea* with over 100 species occurring almost throughout Australia and extending east to Chatham Island, *Thecanthes* with five species occurring in northern Australia and extending north to the Philippines (Figure 1). *Pimelea* is one of the largest, most diverse genera in the family, exceeded in species number probably only by *Gnidia* L.

A revision of species of *Pimelea* and *Thecanthes* (as *Pimelea* sect. *Thecanthes*) from South Australia, Queensland, New South Wales and Victoria has recently been published (Threlfall 1983). This treatment includes a few species that extend into Western Australia but the most comprehensive treatment to date of the Thymelaeaceae in Western Australia is that of Bentham (1873). Apart from four new species names published in preparation for the Flora of the Perth Region (Rye 1984), no new names have been published for endemic Western Australian species since 1915. This paper presents a taxonomic revision of Western Australian Thymelaeaceae, in which 45 species of *Pimelea* and three species of *Thecanthes* are recognised.

History of Pimelea and Thecanthes. The first specimens of *Pimelea* to arrive in Europe were of three New Zealand species collected in 1772 by J.R. and J.G. Forster on Cook's second voyage. The genus was described in 1775 as *Banksia* Forster & G. Forster but Linnaeus f. (1782) reused the name *Banksia* for a genus in the Proteaceae and referred the genus previously known as *Banksia* to the already established genus *Passerina* L. Most subsequent authors accepted the new name *Banksia* L.f. and it was formally conserved by Sprague (1940: 99). However, very few authors accepted the inclusion of the two-staminate Thymelaeaceae from New Zealand and Australia within the originally eight-staminate genus *Passerina*. *Pimelea* Banks & Sol. ex Gaertner was named in 1788, based on the New Zealand species *P. prostrata*.

Brown (1810) published the first substantial treatment of Australian species. He recognised 34 taxa, placing them in five numbered but unnamed sections and giving a brief description of each section. Later Wikstrom (1818) described the genus *Thecanthes* and transferred two species that had previously been described under *Pimelea* to the new genus. Endlicher (1837) recombined *Thecanthes* with *Pimelea* and recognised six infrageneric groups of unspecified rank. These groups corresponded with the sections given by Brown (1810) except that Brown's first section was split into two, *Thecanthes* and *Heterolaena*, the remaining groups being named *Phyllolaena*, *Epallage*, *Malistachys*, and *Choristachys*.

Three new genera, *Gymnococca* Fischer & C. Meyer, *Heterolaena* Fischer & C. Meyer and *Calyptrostegia* C. Meyer, which together accounted for a large majority of the species previously placed in *Pimelea*, were named in two publications of 1845. These and a few later publications resulted in numerous recombinations, particularly in the large genus *Calyptrostegia*. Infrageneric groups, still of unspecified rank, were recognised by Meyer (1845) under the genera *Gymnococca* and *Calyptrostegia*. In the latter genus he included two of Endlicher's groups, *Malistachys* and *Epallage*. Presumably the new genus *Heterolaena* was also meant to correspond with Endlicher's infrageneric group *Heterolaena*. However, Fischer and Meyer (1845) did not acknowledge Endlicher and the only species listed, *Pimelea spectabilis* (as *Heterolaena spectabilis*), had not been named at the time Endlicher listed his species under the infrageneric group *Heterolaena*. Hence the genus and infrageneric group of the same name are regarded as having different types.

Another new genus, *Macrostegia*, was described by Turczaninow (1852). It consisted of the single species *M. erubescens*, which had shortly before been named *Pimelea physodes* Hook. Although *P. physodes* is a very distinctive species, *Macrostegia* was neither accepted as a separate genus nor used as an infrageneric category by any later authors.

A revised classification by Endlicher (1848) retained *Gymnococca* and *Calyptrostegia* as separate genera. However, *Heterolaena* Endl. and *Phyllolaena* were treated as groups of unspecified rank under *Pimelea* while *Thecanthes* and *Choristachys* were treated as groups under *Calyptrostegia* but with *Choristachys* at a higher level than *Thecanthes*. Meissner (1857) recognised only *Pimelea* at the generic level and listed three sections, *Thecanthes*, *Eupimelea* and *Gymnococca*. Under sect. *Eupimelea* he listed eight groups of unspecified rank, consisting of the last five of Endlicher's original groups and three groups of his own.

Subsequent authors have followed Meissner in recognising *Pimelea* as the only genus in this complex. However, Kuntze (1891), who considered that the older name *Banksia* should be used rather than *Pimelea*, published recombinations for most of the then known species of *Pimelea* followed by a new classification of infrageneric groups under *Banksia* (Kuntze 1903). This classification was essentially the same as that given by Bentham (1873). Bentham's classification is compared in Table 1 with the more recent classifications provided by Gilg (1894) and Threlfall (1983). Gilg's classification differed from Bentham's in that *Thecanthes* was recognised as a subgenus rather than a section. The treatment of *Thecanthes* as a subgenus was followed by Domke (1934) in his monograph of the Thymelaeaceae and by Ding Hou (1960) in Flora Malesiana but not by Threlfall (1983) in her revision of the species occurring in four Australian states. Threlfall followed Bentham's classification except that she regarded one of Bentham's subsections under *Calyptrostegia* as a separate section while not recognising the other two subsections.

Nomenclature at the specific and varietal levels in *Pimelea* has been complicated by the publication of many new names based on cultivated material. Cultivation of *Pimelea* species in Europe appears to have commenced in 1793 with the eastern Australian species *Pimelea linifolia*. By 1860, about 20 species had been cultivated, including the following Western Australian species: *P. rosea*, *P. ferruginea*, *P. clavata*, *P. sylvestris*, *P. hispida*, *P. longiflora*, *P. lanata*, *P. imbricata*, *P. spectabilis* and probably *P. floribunda*. In most cases dried specimens were not referred to when new names were published for cultivated plants and often there was also no illustration available to nominate as type. Most of these names are regarded here as nomina dubia.

Materials and Methods

The present classification of Western Australian Thymelaeaceae into genera and sections was derived by examining specimens of all Australian species and by making an assessment

of the major characteristics of extra-Australian species of *Pimelea* from the available literature. A linear systematic sequence for all of the Australian species, in which species were placed as closely as possible to their presumed closest relatives, was drawn up. The sections and species described in this paper are numbered according to their position in the comprehensive sequence. To partly overcome the problem that it is not possible in a linear sequence to place every species or section beside the taxa considered to be its closest relatives, the probable affinities of each taxon are indicated in the systematic treatment. Subspecies and varieties are also listed systematically.

Decisions on the most appropriate taxonomic rank for each taxon, from the varietal level to the generic level, were based on the examination of the gross morphology of herbarium specimens supplemented by limited examination of fresh material. Subspecies are regarded as differing from varieties simply in that they represent a higher degree of evolutionary divergence towards the species level. In most cases infraspecific taxa are treated as subspecies but there are two species in which varieties are recognised. The reasons for the choice of varietal rank are discussed under the two species concerned.

Herbarium specimens of Western Australian species of Thymelaeaceae were borrowed from the following herbaria: AD, ADW, BM, BRI, CANB, CBG, CGE, DNA, K, LD, MEL, NSW, NT, NY and UWA. Descriptions of species and infraspecific categories are based entirely on specimens collected in Western Australia. Where only a small number of specimens was examined for a particular taxon, all are cited. Otherwise a selection is provided to represent the morphological and geographical range of the taxon in Western Australia. All measurements were taken from dry material. Stem colour and leaf colour were noted only from dried material but bract colour and flower colour were determined partly from fresh or very recently dried material and partly from information given on the specimen labels. To minimise repetition, the description of each genus or section primarily gives the constant characters of the group. Individual descriptions of the species within each group do not repeat these constant characters.

Where there were both male and female specimens in the type collection of a dioecious species, the female specimen was chosen as a lectotype. For taxa described by Meissner prior to 1857 from Preiss specimens, a lectotype was chosen if more than one specimen had been annotated by him. Where only one specimen bore Meissner's handwriting that specimen was presumed to be a holotype. Photographs of all types borrowed from interstate or overseas herbaria have been lodged in PERTH. The presence of photographs in PERTH is not indicated under the appropriate taxa in the systematic treatment unless the type specimen was not borrowed and only the photograph seen by me.

The distribution of each taxon in Western Australia was plotted using a symbol to represent each ¼ degree latitude by ¼ degree longitude area from which the taxon had been collected. For each taxon extending outside Western Australia, a second distribution map was prepared, indicating each ½ degree by ½ degree area in which the taxon has been recorded.

For each taxon illustrated, a flowering or fruiting branch was drawn at life size. Individual flowers or floral parts were enlarged. Bisexual and female flowers were drawn at the stage when the style was fully exserted while male flowers and individual stamens were usually drawn when close to the stage of pollen release.

The Present Classification

The genus *Thecanthes* is reinstated here and a revised classification of *Pimelea* provided, with the following seven sections recognised: *Heterantheros, Pimelea, Epallage, Calyptrostegia, Macrostegia, Stipostachys* and *Heterolaena*. Sect. *Heterantheros* and sect. *Stipostachys* are

new while sect. *Macrostegia* is a new combination. Table 1 outlines the relationships between these sections and the groups used in several earlier classifications, further details being provided under the descriptions of each section in the systematic treatment. Table 2 gives the main characteristics of the sections as recognised here. All of the sections are represented in Western Australia and all Western Australian species can be readily keyed to their respective sections.

Table 1: Comparison of the more recent classifications.

Bentham 1873	Gilg 1894	Threlfall 1983	Rye
Pimelea	*Pimelea*	*Pimelea*	
sect. *Thecanthes*	subgen. *Thecanthes*	sect. *Thecanthes*	2. *Thecanthes*
	subgen. *Eupimelea*		1. *Pimelea*
			sect. 1. *Heterantheros*
sect. *Pimelea*	sect. *Autopimelea*	sect. *Pimelea*	sect. 2. *Pimelea*
sect. *Dithalamia*	sect. *Dithalamia*	sect. *Dithalamia*	
sect. *Heterolaena*	sect. *Heterolaena*	sect. *Heterolaena*	sect. 7. *Heterolaena*
			sect. 5. *Macrostegia*
sect. *Calyptrostegia*	sect. *Calyptrostegia*	sect. *Calyptrostegia*	sect. 4. *Calyptrostegia*
subsect. *Calyptridium*	1. *Calyptridium*		
subsect. *Phyllolaena*	2. *Phyllolaena*		
subsect. *Choristachys*	3. *Choristachys*	sect. *Choristachys*	
			sect. 6. *Stipostachys*
sect. *Malistachys*	sect. *Malistachys*	sect. not mentioned	
sect. *Epallage*	sect. *Epallage*	sect. *Epallage*	sect. 3. *Epallage*

Notes on Characteristics of the Genera

Habit and Indumentum. Thecanthes is comprised of annual herbs up to 0.8 metre high. All species of *Thecanthes* are completely glabrous except for one from the Northern Territory, which has simple hairs on the basal portion of the floral tube. As far as is known, all species are strictly annual. One flowering specimen of *T. punicea* was observed to have the remains of old flower heads, but these were probably produced earlier in the same year rather than in the previous year's flowering season. Certainly this specimen was much smaller than many other specimens which showed no sign of previous flowering. However, *T. punicea* has been collected in flower in all months of the year and may be capable of surviving for more than one year when conditions are exceptionally favourable.

Pimelea is a much more speciose and more variable genus than *Thecanthes*. It contains plants varying in habit from annual herbs and prostrate or dwarf undershrubs to very tall shrubs or even trees. Some specimens of *P. lanata* may be large enough to be regarded as trees, the greatest recorded height being about 4 metres. *Pimelea trichostachya,* which is one of the very few annual herbs in the genus, occurs predominantly in arid or semi-arid environments. Most species have axillary tufts of hairs, at least in the axils of immature leaves. Leaves are sometimes hairy and stems more commonly so. In most taxa the flowers have at least a few hairs. Although the hairs are always simple, they are very useful for distinguishing the taxa because they vary greatly in distribution, number, orientation, size and other characters. The variation in the indumentum from the base of the floral tube to the apex of the sepals is particularly important for identification.

While most of the shrub species appear to be readily killed by fire, a few species are able to regenerate from swollen underground parts. *Pimelea sulphurea* is a prime example of a fire-tolerant species. Its underground stock is elongate, extending well below the surface of the ground, and produces multiple stems after fires. A few species of *Pimelea* are able to reproduce vegetatively by adventitious roots from the nodes of prostrate stems but none of the Western Australian species appears to have this capacity.

Table 2: Major characteristics of *Thecanthes* and the sections of *Pimelea*.

Group	Sexual System	Stems and Leaves	Sessile Involucral Bracts	Mature Inflorescence	Flower Size	Floral Tube Persistence	Ovary	Unique Characters
Pimelea sect. 1. *Heterantheros*	dioecious	glabrous	well differentiated	compact	large	not circumscissile, irregularly splitting at base, exposing fruit	glabrous	Receptacle concave with basal bracts. Female inflorescence much hairier than male, the hairs on sterile flowers or bract-like structures.
sect. 2. *Pimelea*	dioecious+	glabrous or hairy	usually leaf-like, absent or much smaller than leaves	compact or rarely elongate	small+	not circumscissile*, irregularly splitting at base or shed intact with fruit	hairy at apex	Mature fruit sometimes succulent.
sect. 3. *Epallage*	hermaphrodite gynodioecious or dioecious	hairy	absent	compact or elongate, often interrupted	small or large	circumscissile	hairy at apex*	Sepals often erect and distinctly connate at base. Rachis narrow even when inflorescence is compact.
sect. 4. *Calyptrostegia*	hermaphrodite or gynodioecious*	glabrous or hairy	usually well differentiated, sometimes leaf-like	compact*, continuous	usually large	circumscissile or very rarely shed intact with fruit.	usually hairy at apex or below	
sect. 5. *Macrostegia*	hermaphrodite	glabrous	very well differentiated	compact	large	circumscissile	glabrous	Sepals erect and free, very elongate. Stamens and style exceptionally long.
sect. 6. *Stipostachys*	hermaphrodite	glabrous	well differentiated	elongate, continuous	large	circumscissile or rarely shed intact with shoot	hairy at apex	Unique among perennials in having nodes not protruding.
sect. 7. *Heterolaena*	hermaphrodite or gynodioecious	glabrous*	well differentiated	compact	large	shed intact with fruit or rarely circumscissile	glabrous	Floral tube nearly always with short or no hairs at base and a band of long patent hairs above.
Thecanthes	hermaphrodite	glabrous	well differentiated	compact	large	circumscissile	glabrous	Glabrous annuals. Receptacle concave with terminal bracts. Pedicels compressed.

\+ with rare exceptions outside Western Australia
* with rare exceptions including Western Australian species

Stems, Leaves and Involucral Bracts. In common with the family as a whole, *Pimelea* and *Thecanthes* have simple entire leaves and the shrub species tend to have very stringy bark. Nodes are prominent in most groups. Leaves are opposite and decussate in *Thecanthes* and most species of *Pimelea*, the remaining species of *Pimelea* having alternate leaves. The petiole is very short and commonly inconspicuous or rarely absent. *Pimelea sessilis* is notable in having uniformly sessile, somewhat stem-clasping leaves (Figure 53A,B). The leaf midrib is prominent on the abaxial surface and usually distinct adaxially. Although the intra-marginal veins are sometimes similarly developed, only a few species, in particular the eastern Australian species *Pimelea ligustrina*, have distinctly reticulate-veined leaves.

Many *Pimelea* species have adaxially concave leaves, which sometimes appear to be completely flat after they have been dried and pressed. Some species have recurved leaf margins and drying sometimes causes the margins to become more recurved or revolute. In other species of *Pimelea* and in *Thecanthes* the leaves are flat.

All species of *Thecanthes* have four involucral bracts while in *Pimelea* the bracts range from one to numerous or are absent. Involucral bracts in both genera are usually broader than the leaves and frequently more colourful but in some *Pimelea* species they are very similar to, or intergrade with, the leaves. Throughout this treatment, the numbers given for involucral bracts refer only to the sessile (rarely subsessile) bracts immediately surrounding the flowers and exclude any rather similar but shortly petiolate structures that may occur shortly below. The latter are referred to as 'bract-like leaves'. Characteristics of the involucral bracts, including their number, colour, size and hairiness, are valuable for distinguishing species and sometimes sections.

Inflorescence and Pedicels. In *Thecanthes* the inflorescence is terminal, erect and head-like, with a concave receptacle and numerous pedicellate flowers. The pedicels, illustrated in Figure 75C,E, are dorsiventrally compressed with an apical articulation point. They tend to be longer than in *Pimelea* and are glabrous. As illustrated in Figure 75B, the four involucral bracts appear to form a continuation of the receptacle. Bentham (1873) and other early authors regarded the structure below the four lobes as the connate lower portion of the bracts but Threlfall (1983) pointed out that it bears pedicels throughout its length and should therefore be regarded as a concave receptacle.

The inflorescence of *Pimelea* is basically racemose but is occasionally reduced to one or two flowers, as in the eastern Australian species *Pimelea pygmaea* and *P. biflora.* In its most common form, the raceme is many-flowered, terminal, erect to pendulous, very condensed and resembles a head, the axis reduced to a convex or nearly flat receptacle. In some species, the axis elongates as flowering proceeds and the inflorescence becomes spike-like. Sometimes the flowers and fruits are densely packed and the inflorescence is described here as continuous, as in *P. holroydii* (Figure 50A). In other cases the old flowers and fruits become separated, as in *P. forrestiana* (Figure 12C), and the inflorescence described as interrupted. In another variation, occurring only in *P. gilgiana*, the inflorescence is superficially similar to that of *Thecanthes* in that the receptacle is distinctly concave but differs in that the bracts are more or less basal.

In *Pimelea* the pedicels are terete or nearly so, articulate at the apex, usually very short and usually densely hairy, a characteristic example illustrated in Figure 12E for a female flower of *P. argentea.* Male flowers of the same species, as illustrated in Figure 12D, have an exceptionally long pedicel. The pedicels of all species persist for some time after the fruits and involucral bracts have been shed but are usually not as persistent as the axis. The axis does not grow out from the old inflorescence; instead any new branch(es) arise from an upper node of the stem below. The persistent remains of the old inflorescence and its original branch are useful for identifying *Pimelea* from other Western Australian plant genera in the vegetative state.

Flower. As in other members of subfam. Thymelaeoideae, *Pimelea* and *Thecanthes* have a well developed floral tube. Most authors have referred to the floral tube and its main lobes as the calyx or perianth and to the additional lobes on the inside (when present) as petals, corolla lobes, appendages or scales. From her examination of the vascular traces in the flowers of a number of genera, including *Pimelea*, Heinig (1951) concluded that the floral tube was entirely appendicular in origin, consisting of the lower calyx together with the adnate portions of the androecium. She regarded the main lobes as calyx lobes and the inner lobes as enations of the calyx, referring to the latter as petaloid scales. Further evidence relating to the structure of the flower in the subfamily was obtained by Bunniger (1972) in his ontogenetic study of the flower anatomy of several genera, again including *Pimelea.* Bunniger concluded that the outer tissue of the tube was axial rather than calycine and that the inner tissue consisted of both the corolla and androecium, the inner lobes being the free part of the corolla. He considered that the calyx arose at the summit of the axial tissue and formed the main floral lobes. Following Bunniger, the main lobes are referred to here as sepals and the inner lobes as corolla lobes. However, the origin of floral structures in Thymelaeaceae needs further investigation.

In *Pimelea* and *Thecanthes* the flowers have four sepals, no corolla lobes and two stamens, except in the Tasmanian species *P. filiformis*, which has only one stamen opposite the adaxial sepal. The floral tube and sepals are usually similar in texture and colour. They range from white to very deep red in *Thecanthes*, while in *Pimelea* they are usually white, pink or yellow. The flowers often appear more colourful in bud than after opening. Apart from the indumentum characters noted earlier, the floral characters of greatest diagnostic value are flower size and colour, the shape of the floral tube, the length of the stamens relative to the sepals and the shape and dehiscence of the anther.

The floral tube in *Thecanthes* and most species of *Pimelea* is swollen around the ovary and slender above. The more or less fusiform proximal portion is referred to here as the ovary-portion and the distal portion, which is usually almost cylindric but expanded towards the summit, as the style-portion. In some species of *Pimelea,* such as *P. micrantha*, the tube is scarcely continued above the ovary. A few species, notably *P. physodes* (Figure 45B), have a constriction in the floral tube.

In both genera one pair of sepals overlaps the alternate pair in bud. The stamens are inserted opposite the two outer sepals, usually at the level where the sepals separate or slightly below. The sepals are usually widely spreading at anthesis. Some species in sect. *Epallage*, including *P. trichostachya*, have erect sepals which appear to be connate at the base in a short tube. In descriptions of these species the entire length of the tubular part of the flower is still referred to as the floral tube but the lobes are referred to as 'sepals (or free lobes)'. Many species of *Pimelea* and all species of *Thecanthes* have stamens with a well developed filament, a narrow connective and the anther somewhat to fully latrorse or at least appearing so in dried specimens. At the other extreme, there are several Western Australian species, including *P. longiflora* (Figure 25E,F), that have subsessile (i.e. with a very short filament) anthers with a connective so broad that it slightly exceeds the cells laterally, the dehiscence being strictly introrse. In the species descriptions given here the position of the slits through which the pollen has been released is described as adaxial in the latter type of anther and lateral or semi-lateral in the more common types of anthers.

Nectar accumulates within the proximal portion of the floral tube surrounding the ovary. In most species the nectary disc or ring of glands is not easily seen. However, some species have well developed nectary glands in a ring surrounding the stipe or base of the ovary. For example, *P. cracens* has about eight filiform glands, up to 2.5 mm long.

Both genera have a two-carpellate gynoecium but the ovary is functionally one-loculate at maturity because one carpel aborts at a very early stage. The style arises laterally shortly below the apex of the ovary, is straight except near the insertion point and always glabrous. It is filiform and prominently exserted from the throat of the floral tube in *Thecanthes* and often in *Pimelea*. However, it is sometimes very short in the latter genus, particularly in some dioecious species such as *P. serpyllifolia*. The stigma is terminal, small and with short papillae or, in some *Pimelea* species, prominently enlarged and with long papillae.

Fruit. Thecanthes and *Pimelea* have an indehiscent one-seeded fruit. The floral tube may be persistent or partly to almost completely deciduous. The sepals remain attached to the floral tube or very rarely, for example in some plants of *P. forrestiana*, are shed. A regularly circumscissile floral tube characterises *Thecanthes* and also occurs in most members of sections *Calyptrostegia, Epallage* and *Stipostachys*. Circumscission almost always occurs above the summit of the fruit and the fruit remains enclosed in the persistent base of the floral tube, as in *P. suaveolens* subsp. *flava* (Figure 39F). In one or two species, such as *P. holroydii*, the floral tube becomes brittle and may be easily, but irregularly, broken above the fruit in some flowers. Such species are not regarded here as having circumscissile flowers. A persistent floral tube occurs in most species of sect. *Heterolaena* and is also fairly common in sect. *Pimelea*. In this case the fruit becomes detached from the plant together with the entire floral tube and usually the sepals. A deciduous floral tube is common in sect. *Pimelea* and also occurs in sect. *Heterantheros*. In this case the floral tube splits irregularly in the swollen basal portion as the fruit enlarges and is shed (apart from an irregular basal ring) before the fruit reaches maturity, the mature fruit being greatly enlarged and often succulent. In the other cases described above, the fruit is dry and not so greatly enlarged.

In sect. *Heterolaena*, which has a persistent floral tube, the tube is always hairy and usually has a band of long hairs above the ovary-portion. In contrast, most species with a circumscissile floral tube have the longest hairs below the circumscission point, that is mainly on the ovary-portion. Others are either glabrous or have deciduous hairs. If the function of the long hairs were purely for the protection of the seed they might be expected to be best developed on the ovary-portion in all species. It appears that they assist in the dispersal of the fruits, their higher position in fruits with a persistent floral tube being related to this function.

The seed in dry-fruited species has a black seed coat with a pattern of pits, shallow protrusions or irregular features. Threlfall (1983) has described and provided good illustrations of the various patterns on the seeds.

Chromosome Number. The base chromosome number for the Thymelaeaceae is x = 9 (Federov 1974). In *Pimelea* the lowest and most commonly recorded number is the tetraploid n = 18. Tetraploidy has been recorded, almost invariably from somatic cells, from three species in New Zealand (Elaise 1959, Rattenbury 1957) and 11 species in Tasmania (Cruickshank 1953). The other numbers recorded, each from one species in Tasmania (Cruickshank 1953) are n = 36, 45 and 54, these being octoploid, decaploid and dodecaploid respectively. There do not appear to have been any counts published for *Pimelea* species endemic to mainland Australia nor for any species of *Thecanthes*.

Breeding System. All species of *Thecanthes* are hermaphrodite. In *Pimelea,* hermaphroditism, dioecy and gynodioecy are all common. There are minor deviations from these three main states in some species. For example a basically gynodioecious species may have occasional plants producing both female and bisexual flowers.

Dioecious species appear to have a 1:1 ratio of male to female plants, judging from the approximately equal numbers of male and female herbarium specimens of each taxon, from the published figures for two dioecious species from Tasmania (Cruickshank 1953) and from

very limited field observations. In gynodioecious species the ratio of bisexual to female flowers varies considerably but, where there is a difference, it is nearly always the female plants that are rarer. A study of four gynodioecious species in New Zealand by Burrows (1960) revealed that female plants set seed more frequently than bisexual plants. Two of these species usually had equal numbers of female and bisexual plants in their populations and the female plants set 17-21 times as many seeds as bisexual plants. The other two species had more bisexual than female flowers, usually 1.5-3 times as many but up to ten times as many in one population, and female flowers set seed about two or ten times (depending on the species) more commonly than bisexual flowers.

Bisexual flowers of both *Pimelea* and *Thecanthes* are, or at least appear to be, protandrous. The anthers shed their pollen when the flowers first open, at which stage the style is not or only shortly exserted. The style does not reach its maximum length until much later, perhaps several days. However, it is not known when the stigma first becomes receptive to pollen or for how long it remains receptive in Australian species. In the gynodioecious species studied by Burrows (1960) in New Zealand, the stigma was receptive to pollen when the flower first opened and remained receptive for up to three days but ceased to be receptive before the style reached its maximum elongation, which only occurred if the flower remained unpollinated. In bisexual flowers the stigma was receptive only before it became exserted and successful pollination was rare, whereas in female flowers the receptive stigma was exserted and much more likely to be pollinated.

In dioecious species, male flowers are not or only slightly enlarged at the base of the floral tube and are usually longer than the female flowers. The small pistillode (when present) is not exserted. Female flowers have staminodes, which can be distinguished from stamens by their smaller size as well as the lack of pollen. Male and female flowers are illustrated for several dioecious species, such as *P. clavata* (Figure 5) and, in the case of *P. gilgiana* (Figure 2), a sterile flower in also illustrated. In gynodioecious species, the female flowers often have a shorter floral tube than bisexual flowers but the style is as long as or sometimes even longer than in bisexual flowers. Bisexual flowers of *P. longiflora* have the style included or scarcely exserted whereas the similar-sized female flowers have a longer exserted style. More commonly, the style is almost the same length in bisexual and female flowers but is more exserted in female flowers because these have a shorter floral tube. Illustrations of bisexual and female flowers are provided for the gynodioecious species *P. sulphurea* (Figure 34) and *P. aeruginosa* (Figure 38).

Butterflies and moths are probably the principal pollinators of *Thecanthes* and those species of *Pimelea* with large slender flowers. Their long slender probosces are able to penetrate the narrowly cylindric style-portion of the floral tube to reach the nectar at the base of the flower. Keighery (1975) recorded at least eight species of butterflies visiting flowers of about nine of the large-flowered species of *Pimelea* in Western Australia. He also recorded a bird species visiting the flowers of *P. physodes*. *Pimelea physodes* is the only species that appears to have the style-portion of the floral tube sufficiently broad throughout its length to be penetrated by a bird's tongue. *Pimelea* species with small flowers, especially those with the floral tube only shortly extended above the ovary, are probably pollinated by a variety of insects. Burrows (1960) recorded bees, flies, small butterflies and moths, beetles and bugs visiting the small flowers of four New Zealand species of *Pimelea*. He concluded that a bee species and several fly species were the main pollinating agents, at least during daylight.

Burrows reported widespread hybridisation between the four New Zealand species. The degree of hybridisation was sufficiently extensive in some cases to be regarded as introgression. Detailed population studies have not been conducted on Australian species and the frequency of hybridisation in unknown.

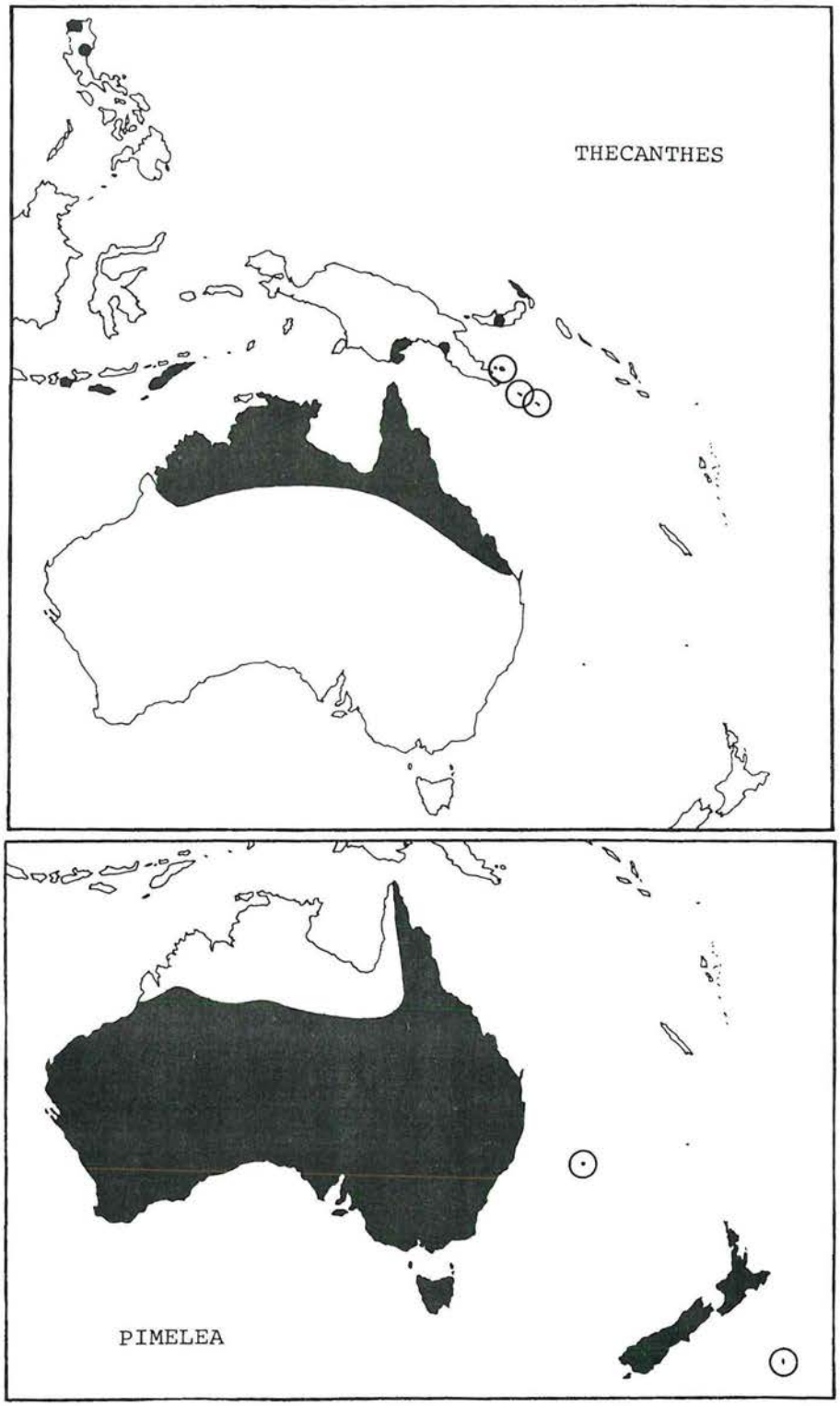

Figure 1. Distribution of *Pimelea* and *Thecanthes*.

Biogeography

Figure 1 gives the complete distributions of *Pimelea* and *Thecanthes*. In Western Australia the family occurs throughout the state but with scarcely any overlap in the ranges of the two genera. *Thecanthes* is confined to the far north, within the area defined as the Northern Botanical Province by Beard (1980), whereas *Pimelea* occurs throughout the remainder of the state and in the southern part of the Northern Botanical Province. All of the three Western Australian species of *Thecanthes* extend into Northern Territory, one species also occurring in Queensland and another species also occurring in parts of southern Indonesia.

Of the 45 Western Australian species of *Pimelea*, 36 are endemic in the south-west of the state, many confined to the South-west Botanical Province and others extending slightly into adjacent parts of the Eremaean Botanical Province. Another species, *P. angustifolia*, is also recorded from Eucla, which is almost on the South Australian border. The endemics from the south-west include the monotypic sections *Heterantheros* and *Macrostegia* and all members of sect. *Heterolaena*. The only species endemic in the Western Australian part of the Eremaean, *P. holroydii*, occurs mainly in the Pilbara region.

Two closely related species, *Pimelea imbricata* and *P. subvillifera*, occur both in the south-west of Western Australia and in southern South Australia but with a large disjunction between these two areas. There are five other non-endemic Western Australia species, each with an apparently continuous distribution, *P. ammocharis, P. microcephala* and *P. trichostachya* being widespread in the Eremaean Botanical Province while *P. serpyllifolia* and *P. micrantha* extend along the south coast around the Great Australian Bight.

Systematic Treatment

FAMILY THYMELAEACEAE

Usually *shrubs* or *trees* with a stringy bark, rarely *herbs* or *lianes,* often with simple hairs. *Stipules* absent or vestigial. *Leaves* simple, entire. *Flowers* actinomorphic or rarely slightly zygomorphic, usually with a well developed corolla-like floral tube interpreted as consisting of axial tissue on the outside and corolline and staminal tissue on the inside, the tube usually cylindric to campanulate. *Calyx* usually corolla-like, with 3-6 (usually 4 or 5) sepals or lobes or rarely erose, arising at the summit of the floral tube and appearing to be a continuation of it, or possibly sometimes basal. *Corolla lobes* (when present) as many as or more than the sepals, usually smaller than the sepals, often scale-like. *Stamens* (1-)2-10(-80), often twice as many as the sepals and often in 2 whorls, inserted at the throat of the flower or within the tube; anther cells 2, parallel, longitudinally dehiscent. *Nectary disk* often present around the base of the ovary, sometimes as distinct glands. *Ovary* free, superior, 2-12-carpellate, 1-12-loculate at maturity, commonly 2-carpellate but often with 1 carpel aborting early so that the ovary is functionally 1-loculate; ovules 1 per carpel, pendulous. *Style* simple; stigma capitate or truncate. *Fruit* dry or succulent, usually indehiscent, sometimes a loculicidal capsule. *Embryo* oily, straight. *Base chromosome number*: x = 9.

A family of about 50 genera and 500 species, occurring in temperate and tropical regions, especially in Africa and from south-eastern Asia to Australia, 2 genera occurring in W.A.

Key to Genera

1. Usually shrubs, very rarely annual herbs and then with sparsely to densely hairy stems. Involucral bracts 0-40 or more. Pedicels terete, often hairy.....1. *PIMELEA*
1. Glabrous annuals. Involucral bracts 4. Pedicels dorsiventrally compressed, glabrous.....2. *THECANTHES*

1. **PIMELEA** Banks & Sol. ex Gaertner

Pimelea Banks & Sol. ex Gaertner, Fruct. Sem. Pl. 1: 186 (1788), nom. cons. *Type: P. laevigata* Gaertner (= *P. prostrata* (Forster & G. Forster) Willd.).

Banksia Forster & G. Forster, Char. Gen. Pl. 7, t. 4 (1775), nom. rej., non Linn. f. (1782), nom. cons. — *Cookia* J. Gmelin, Syst. Nat. 2: 24 (1791), nom. illegit. *Type: P. gnidia* (Forster & G. Forster) Willd. (as *Banksia gnidia* Forster & G. Forster in former genus and as *Cookia gnidia* (Forster & G. Forster) J. Gmelin in latter genus) (lecto: fide S. Threlfall, Brunonia 5: 118 (1983)).

Gymnococca Fischer & C. Meyer, Index Sem. Hort. Petrop. 10: 46 (1845). *Type: P. drupacea* Labill. (as *G. drupacea* (Labill.) Fischer & C. Meyer).

Heterolaena Fischer & C. Meyer, Index Sem. Hort. Petrop. 10: 47 (1845). *Type: P. spectabilis* Lindley (as *H. spectabilis* (Lindley) Fischer & C. Meyer).

Calyptrostegia C. Meyer, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 72 (1845). *Type: C. hypericina* (A. Cunn. ex Hook.) C. Meyer (= *Pimelea ligustrina* Labill. subsp. *hypericina* (A. Cunn. ex. Hook.) Threlfall).

Macrostegia Turcz., Bull. Soc. Imp. Naturalistes Moscou 25/2: 177 (1852). *Type: M. erubescens* Turcz. (= *P. physodes* Hook.).

Prostrate to *tall shrubs* or rarely *herbs* with a woody base, usually erect, usually hermaphrodite, gynodioecious or dioecious; hairs simple, usually colourless and silky. *Branches* with a stringy bark; upper stems usually with rather inconspicuous tufts of hairs in the leaf axils. *Leaves* usually opposite and decussate, shortly petiolate or rarely sessile; midrib prominent on abaxial surface and often yellowish. *Inflorescence* usually a simple terminal raceme, rarely of almost axillary racemes each terminating in a very short axillary branchlet; raceme(s) usually very condensed, often head-like, rarely reduced to 1 or 2 flowers, often with an involucre of bracts. *Pedicels* terete or nearly so, usually very short and hairy, articulate at apex. *Flowers* white to red or yellow; bisexual flowers protandrous or appearing so. *Floral tube* often hairy outside, glabrous or sometimes hairy in the distal part inside, of 2 usually distinct portions surrounding the ovary and style respectively; ovary-portion usually fusiform; style-portion usually either narrowly cylindric and expanding slightly to the summit or very short. *Sepals* 4; outer pair overlapping inner pair in bud, often more hairy than inner pair. *Corolla lobes* absent. *Stamens* 2 (in W.A.), inserted at the summit of the tube opposite the outer sepals; anther usually yellow or orange at maturity, then becoming brown. *Ovary* 2-carpellate at first, effectively 1-loculate at maturity, usually green; ovule 1. *Style* subterminal, filiform; stigma usually globular or scarcely enlarged, small and papillose or larger and brush-like. *Fruit* indehiscent, dry or sometimes succulent, usually remaining enclosed in the base of the floral tube. Recorded *chromosome numbers*: n = 18, 36, 45 and 54.

A genus of c. 107 species, 1 species endemic to Lord Howe Island, 17 species endemic to New Zealand and Chatham Island, and the remainder endemic in Australia, 45 species occurring in Western Australia. *Pimelea* species extend throughout Australia except for some areas in the extreme north, occurring in a wide range of habitats, from alpine to desert. In Western Australia, *Pimelea* is absent from the Northern Botanical Province except for *P. ammocharis*, which occurs only in the southern parts of the province.

Notes. The name *Pimelea* is derived from the Greek word *pimele* (soft fat), in reference to the oily seeds or to the fleshy cotyledons. Chromosome numbers have not been counted from Western Australian material of the genus but 2n = 36 has been recorded from a Tasmanian population of *P. serpyllifolia*, which also occurs in Western Australia.

Key to Sections

1. Receptacle prominently concave. Female inflorescence much hairier than male inflorescence .....sect. 1. *Heterantheros*
1. Receptacle more or less flat or convex or the axis elongate. Female inflorescence (if present) not noticeably hairier than male or bisexual inflorescence.
   2. Perennials; stem nodes not protruding abaxially beyond petioles. Inflorescence elongate at maturity; involucral bracts 4-7, glabrous outside.....sect. 6. *Stipostachys*
   2. Perennials or rarely annuals; stem nodes abaxially prominent except in annuals, usually about twice as thick as petioles. Inflorescence usually compact, if elongate then involucral bracts absent or 4 and hairy outside.
      3. Plants dioecious. Floral tube usually splitting irregularly at base in fruit or persistent, rarely circumscissile; ovary-portion longer than style-portion. Fruit succulent or dry.....sect. 2. *Pimelea*
      3. Plants hermaphrodite or gynodioecious or rarely dioecious. Floral tube circumscissile above ovary in fruit or, if persistent, then ovary-portion shorter than style-portion. Fruit dry.
         4. Floral tube prominently constricted at circumscission point, glabrous inside. Sepals very narrowly triangular. Stamens 12 mm longsect. 5. *Macrostegia*
         4. Floral tube not prominently constricted or, if so, then hairy inside above circumscission point. Sepals narrowly ovate to elliptic. Stamens 10 mm long.
            5. Ovary glabrous. Floral tube not circumscissile or, if so, then with short hairs on ovary-portion and a zoneof much longer patent hairs above.....sect. 7. *Heterolaena*
            5. Ovary hairy or, if not, then floral tube circumscissile above ovary in fruit; hairs of floral tube (when present) not as above.
               6. Sessile involucral bracts absent. Ovary-portion of floral tube longer than style-portion.....sect. 3. *Epallage*
               6. Sessile involucral bracts present. Ovary-portion of floral tube shorter than style-portion.....sect. 4. *Calyptrostegia*

Key to Species

1. Plants dioecious.
   2. Floral tube of female flowers 5-11 mm long; style-portion much longer than ovary-portion.
      3. Stems and leaves hairy. Fruit enclosed in the persistent base of floral tube.....11. *P. ammocharis*
      3. Stems and leaves glabrous. Fruit naked at maturity.....1. *P. gilgiana*
   2. Floral tube of female flowers 1.5-3.5(-5) mm long; style-portion shorter than ovary-portion.
      4. Flower cluster on a very short axillary branchlet, appearing strictly axillary. Male pedicels 1.5-6 mm long.....9. *P. argentea*
      4. Flower cluster terminal or on a short but definite axillary branchlet. Male pedicels 0.2-1 mm long.
         5. Leaves 1-5-(6) mm long.
            6. Stems hairy near each inflorescence. Flowers glabrous or nearly so outside, somewhat to very hairy inside floral tube.....2. *P. serpyllifolia*
            6. Stems glabrous. Flowers hairy outside, glabrous inside.....3. *P. halophila*
         5. Leaves mostly 10-20 mm long, always with some 6 mm long.

7. Flowers densely hairy outside. Fruit succulent.
8. Stems hairy at first. Fruit enclosed in persistent base of floral tube ..... 4. *P. clavata*
8. Stems glabrous. Fruit naked at maturity ..... 5. *P. microcephala*
7. Flowers glabrous. Fruit dry.
9. Pedicels densely hairy. Inflorescence compact or sometimes elongate at maturity, rarely appearing branched, subtended by 2 or 4 sessile leaf-like bracts ..... 6. *P. spiculigera*
9. Pedicels glabrous or subglabrous. Inflorescence elongate at maturity, commonly appearing branched, each 'branch' subtended by a deciduous brown bract and petiolate leaves ..... 7. *P. forrestiana*

1. Plants hermaphrodite or gynodioecious.
10. Stems very pale yellow-brown in distal 100-200 mm. Inflorescence elongate at maturity; involucral bracts 4-7, glabrous outside ..... 31. *P. holroydii*
10. Stems either becoming brown or grey to black shortly below apex or (in *P. trichostachya*) becoming reddish. Inflorescence compact or, if elongate, then bracts either 4 and hairy outside or absent.
11. Ovary glabrous. Floral tube not circumscissile or, if so, then with short hairs on ovary- portion and a zone of much longer patent hairs above.
12. Leaf margins flat or incurved.
13. Stamens shorter than sepals; filament 0.3-1.5 mm long ..... 44. *P. brevifolia*
13. Stamens equalling to greatly exceeding (very rarely shorter than) sepals; filament 2-7 mm long.
14. Sepals hairy inside. Ovary-portion of floral tube with antrorse hairs ..... 35. *P. spectabilis*
14. Sepals glabrous inside. Ovary-portion of floral tube glabrous or with reflexed to retrorse (rarely patent) hairs.
15. Floral tube glabrous inside, the long hairs on outside mixed with short hairs. Sepals moderately densely hairy, with both long and short hairs.
16. Outer involucral bracts with distinct yellow margins 0.5-1.5 mm wide. Flowers circumscissile ..... 43. *P. lanata*
16. Outer involucral bracts not as above. Flowers not circumscissile ..... 42. *P. hispida*
15. Floral tube often with hairs inside at throat, the long hairs on outside usually not mixed with short hairs. Sepals sparsely hairy, the hairs all of a similar size.
17. Ovary-portion of floral tube glabrous or with patent to antrorse hairs. Leaves discolorous, with a sheen on adaxial surface ..... 32. *P. lehmanniana*
17. Ovary-portion of floral tube with reflexed hairs. Leaves concolorous, dull ..... 34. *P. rara*
12. Leaf margins recurved to revolute laterally or recurved at apex only.
18. Anthers subsessile, with strictly adaxial slits; cells slightly exceeded laterally by the connective. Stigma not or scarcely exserted ..... 38. *P. brevistyla*
18. Anthers with a distinct filament, the slits lateral or semi-lateral after dehiscence; cells laterally exceeding the connective. Stigma prominently exserted.

19. Longest hairs of floral tube not mixed with short hairs, at least 4 times longer than shortest hairs of tube.
    20. Leaves shortly petiolate, not stem-clasping. Floral tube with a ring of hairs inside at throat.....32. *P. lehmanniana*
    20. Leaves sessile, somewhat stem-clasping at base. Floral tube glabrous inside.....33. *P. sessilis*
19. Longest hairs of floral tube mixed with short hairs or (sometimes in *P. brachyphylla*) not much longer than shortest hairs of tube.
    21. Anthers 0.3-0.5 mm long. Floral tube 4-8 mm long, white .....45. *P. brachyphylla*
    21. Anthers 0.6-1.5 mm long. Floral tube 8-18 mm long or, if 7-8 mm long, then flowers pink.
        22. Inner involucral bracts hairy inside except on margin....43. *P. lanata*
        22. Inner involucral bracts glabrous inside or with hairs confined to base or centre.
            23. Stamens slightly to greatly exceeding sepals; filament 3.25-5.5 mm long. Leaves acute.....39. *P. ciliata*
            23. Stamens shorter than to exceeding sepals; filament 0.7-2.5(-3) mm long, if 2.5-3 mm long then leaves obtuse.
                24. Flowers pale to deep pink. Leaves not becoming revolute.
                    25. Stems glabrous. Leaves flexible. Peduncle 4-35 mm long .....40. *P. rosea*
                    25. Stems often somewhat hairy at first. Leaves rather stiff. Peduncle up to 3 mm long.....41. *P. ferruginea*
                24. Flowers white to pale yellow at maturity. Leaves mostly becoming revolute when dried.
                    26. Flowers pale yellow or cream; tube 12-18 mm long, the longest hairs 3-4.5 mm long.....36. *P. leucantha*
                    26. Flowers white; tube 8-12 mm long, the longest hairs 1.5-2(-3) mm long.....37. *P. avonensis*

11. Ovary hairy or, if not, then floral tube circumscissile above ovary in fruit; hairs of floral tube (when present) not as above.
    27. Style-portion of floral tube shorter than ovary-portion. Sessile involucral bracts absent.
        28. Inflorescence elongate at maturity. Floral tube 3-4 mm long, the longest hairs 2.5-3 mm long.....8. *P. trichostachya*
        28. Inflorescence compact. Floral tube 2-2.5 mm long, with hairs up to 0.5 mm long.....10. *P. micrantha*
    27. Style-portion of floral tube longer than ovary-portion in flower. Sessile involucral bracts present.
        29. Sepals erect, very narrowly triangular, 5-9 mm long. Stamens: filament 11.5-16 mm long; anther 2-3 mm long.....30. *P. physodes*
        29. Sepals spreading, narrowly ovate to elliptic, 1.5-6 mm long. Stamens: filament up to 7 mm long; anther 0.5-2 mm long.
            30. Flowers hairy inside in the distal half of floral tube. Flower head erect.
                31. Flowers glabrous outside. Bracts 6(8), usually distinct from the leaves.
                    32. Anther slits semi-lateral. Floral tube white or, if pink, then distinctly expanded in distal half.....17. *P. sylvestris*
                    32. Anther slits strictly adaxial. Floral tube pink, only slightly expanded in distal half.....18. *P. calcicola*

31. Flowers hairy outside. Bracts (6-)8-numerous, usually similar to and often grading into the leaves.
    33. Leaves alternate, often crowded, glabrous. Involucral bracts c. 40.....12. *P. graniticola*
    33. Leaves opposite or, if alternate, then usually hairy. Involucral bracts 8-20.
        34. Ovary-portion of floral tube densely hairy throughout. Leaves usually alternate.
            35. Hairs of floral tube not longer on ovary-portion or slightly longer and grading into somewhat shorter hairs on distal part of style-portion. Leaves usually medium green to dark bluish green or deep green.....13. *P. imbricata*
            35. Hairs of floral tube long on ovary-portion, suddenly becoming distinctly shorter on style-portion. Leaves usually pale to medium grey-green.....14. *P. subvillifera*
        34. Floral tube glabrous at extreme base of ovary-portion, densely hairy above. Leaves opposite.
            36. Young stems hairy. Bracts reflexed in fruit.....15. *P. villifera*
            36. Stems glabrous. Bracts not reflexed in fruit.....16. *P. erecta*
30. Flowers glabrous inside. Flower head pendulous or erect.
    37. Young stems hairy. Leaves alternate or opposite, hairy when young.
        38. Longest hairs of floral tube 7-9 mm long. Involucral bracts 6-12 .....11. *P. ammocharis*
        38. Hairs of floral tube up to 2 mm long. Involucral bracts 4-6 .....19. *P. longiflora*
    37. Stems glabrous. Leaves opposite, glabrous.
        39. Anthers subsessile at throat of floral tube, strictly introrse; cells laterally exceeded by connective. Stigma not or scarcely exserted from throat.....20. *P. preissii*
        39. Anthers definitely exserted, the slits usually semi-lateral after dehiscence; cells laterally exceeding the connective. Stigma distinctly exserted.
            40. Inner involucral bracts densely ciliate around apex.
                41. Longest cilia of bracts 0.5-1 mm long. Longest hairs of the floral tube concentrated towards the base. Ovary with a terminal tuft of hairs.....23. *P. sulphurea*
                41. Longest cilia of bracts (1)2-3.5 mm long. Longest hairs of floral tube occurring throughout style-portion. Ovary hairy but hairs not in a terminal tuft.
                    42. Ovary-portion of floral tube with both long and short hairs throughout. Inner involucral bracts glabrous or sometimes slightly hairy inside.....27. *P. tinctoria*
                    42. Ovary-portion of floral tube with short hairs, the long hairs (when present) confined to distal part. Inner bracts usually hairy inside.....28. *P. suaveolens*
            40. Involucral bracts not or scarcely ciliate.
                43. Ovary-portion of floral tube with dense deciduous hairs 3-4 mm long.....29. *P. drummondii*
                43. Ovary-portion of floral tube glabrous or with sparse to dense persistent hairs 1-3.5 mm long.

44. Outside of flower with long hairs on the ovary-portion of floral tube, with a close dense covering of shorter hairs above. Flower head erect or pendulous.
    45. Bracts not reddish or the colour not confined to base, slightly overlapping. Hairs of floral tube all patent to antrorse.....21. *P. angustifolia*
    45. Bracts reddish at the base outside, greatly overlapping. Floral tube with minute retrorse hairs occurring for 2-4 mm above the circumscission point, the hairs above patent to antrorse.....22. *P. floribunda*
44. Flowers either subglabrous to glabrous or with a relatively sparse indumentum of spreading hairs. Flower head pendulous.
    46. Flowers glabrous, pale green. Ovary glabrous or hairs confined to basal half.....24. *P. pendens*
    46. Flowers often with at least a few hairs on sepals, if glabrous then yellow. Ovary hairy throughout.
        47. Sepals glabrous or with a few hairs along midrib outside. Leaves obtuse or narrowly obtuse. Flowers yellow.....25. *P. aeruginosa*
        47. Sepals hairy outside; hairs not confined to midrib. Leaves acute. Flowers creamy green to pale yellow .....26. *P. cracens*

Sect. 1. **Heterantheros**

Pimelea sect. *Heterantheros* Rye, sect. nov.

Frutices dioici. Caules glabri; nodi prominentes. Involucri bracteae 4 vel 6. Inflorescentia mascula compacta; receptaculum concavum, supra insertionem bractearum extensum. Inflorescentiae femineae a masculis indumento in pedicellis et floribus abortivis vel in receptaculo densiore et longiore. Tubus floralis proportione stylari quam ovariali longiore, basi irregulariter fissus sub fructu exutus. Ovarium glabrum. Fructus siccus.

Typus: Pimelea gilgiana.

Shrubs, dioecious. *Stems* glabrous except for inconspicuous hairs in upper leaf axils; nodes abaxially prominent, up to twice as thick as petiole. *Leaves* opposite, shortly petiolate, glabrous. *Involucral bracts* 4 or sometimes 6, well differentiated from leaves, erect, glabrous. *Male inflorescence* head-like, terminal, many-flowered; receptacle concave, extended as a rather thin annular structure above insertion point of involucral bracts, the basal pedicels arising more or less level with the base of each inner bract. *Female inflorescence* as described for male inflorescence, differing from male inflorescence in having additional and longer hairs, the longer hairs occurring on pedicels and aborted flowers or on receptacle. *Pedicels* hairy or glabrous. *Flowers* medium-sized to large, hairy outside, glabrous inside. *Floral tube* with style-portion much longer than ovary-portion, persistent in immature fruit, splitting irregularly in ovary-portion as fruit expands and tardily shed. *Sepals* spreading. *Stamens* 2; connective narrower than anther; slits lateral after dehiscence. *Ovary* glabrous. *Style* filiform; stigma large, brush-like. *Fruit* dry, naked at maturity.

A section of 1 species, occurring in south-western Australia.

Notes. The single species of this section was not described until after Bentham's (1873) treatment. It is unique in having a strongly concave receptacle extended above the base of the involucral bracts. A second unique feature is the presence in the female inflorescence of either sterile flowers or bract-like structures with hairs longer than those on the female flowers. In other respects this section appears similar to sect. *Pimelea* except that the involucral bracts are better differentiated and the flowers larger than is typical for sect. *Pimelea.*

1. **Pimelea gilgiana** E. Pritzel in Diels & E. Pritzel, Bot. Jahrb. Syst. 35: 396-397, t. 46 (1904). *Type:* Geraldton, July 1901, *E. Pritzel* 429 (lecto here designated: PERTH); S of Geraldton, 27 June 1901, *L. Diels* 3197 (isosyn: PERTH).

Shrub, erect, 0.35-1.2 m high, single-stemmed at ground level, many-branched above. *Stems* pale green near each inflorescence, usually becoming medium brown to black further from apex, eventually becoming grey. *Leaves* usually patent or widely antrorse; petiole usually 0.3-1.5 mm long; lamina concolorous, medium green, usually narrowly ovate to narrowly obovate, sometimes more or less elliptic, 3-23 x 1.5-6(-7) mm, flat or adaxially concave, more or less acute. *Peduncle* up to 1.5 mm long. *Male inflorescence*: involucral bracts green, broadly ovate to almost circular and 8.5-10.5 x 7-10.5 mm or the outermost bracts (when 6 present) narrower; receptacle extended c. 1 mm above insertion point of bracts, glabrous; pedicels

c. 0.3 mm long, glabrous or sometimes with hairs 0.3-3 mm long. *Female inflorescence*: involucral bracts reddish green in flower, deep red-purple in fruit, ovate to almost circular, 5-15 x 7-15 mm; receptacle extended as an entire thin annulus 1.5-2 mm above insertion point of bracts in flower, up to 7 mm long in fruit, glabrous outside except at summit, densely hairy inside and at summit, the hairs antrorse and up to 5 mm long; pedicels 0.3-1.3 mm long, with hairs up to 5 mm long. *Male flowers* white or pinkish; floral tube narrowly cylindric, 6-7 mm long, c. 1 mm diam. at summit, glabrous in basal 1-2 mm, with rather coarse, antrorse or patent, sometimes tangled hairs above, the longest hairs 0.6-1 mm long; sepals more or less elliptic, 2-3.2 mm long, with hairs similar to those on tube; stamens shorter or longer than sepals, the filament 1.2-2.5 mm long and anther 0.4-0.8 x 0.3-0.5 mm; pistillode absent or with an abortive ovary c. 0.3 mm long. *Female flowers* white; floral tube c. 5.5 mm long, c. 0.3 mm diam. at summit, the ovary-portion 1.5-2 x c. 0.6 mm and glabrous, the style-portion cylindric and c. 4 mm long, with coarse hairs on style-portion, the longest hairs c. 1 mm long; sepals narrowly ovate to ovate, c. 1.5 mm long, with hairs similar to those on distal part of tube; staminodes with a filament up to 0.5 mm long and anther c. 0.2 x 0.1 mm; ovary c. 1 mm long; style exserted by 1-2.5 mm. *Abortive flowers* of female inflorescence with a reduced compressed floral tube and often sepals but without staminodes and pistillode, white, 0.5-3 mm long, the sepals up to 0.3 mm long, densely hairy throughout on tube; hairs antrorse to patent, the longest hairs 3-5 mm long. *Seed* c. 4 x 2 mm, with longitudinal rows of small deep pits. (Figure 2.)

Specimens examined. WESTERN AUSTRALIA (selected from over 30 seen): S of Lynton on road to Port Gregory, *A.M. Ashby* 4524 (AD); Tamala Station, *J.S. Beard* 6820 (PERTH); between Georgina and Greenough, *J.S. Beard* 6917 (PERTH); 5 km S of Leeman, *E.A. Griffin* 806 (PERTH); Dirk Hartog Island, *K.F. Kenneally* 1355 (PERTH); Horrocks Beach, *R. Melville* 4185 & *J. Calaby* (MEL, PERTH); Geraldton, *C.H. Ostenfeld* 775 (PERTH); 7 km S of Kalbarri, *P.G. Wilson* 6729 (PERTH); c. 10 mi [16 km] S of Dongara, Sept. 1967, *M. Wittwer* (PERTH).

Distribution. (Figure 5.) Extends from Dirk Hartog Island (26°05' S, 113°10' E) south to near Leeman (c. 29°57' S, 114°58' E), always within 30 km of the coast.

Habitat. Occurs close to the coast associated with outcropping limestone, in sand pockets or sometimes in crevices in the rock, often in thickets.

Flowering period. May-September.

Affinities. A very distinct species with no close relatives.

Notes. The receptacle of female inflorescences sometimes bears obvious sterile flowers at the summit but sometimes merely appears to become lacerate and hairy at the summit. The latter situation presumably represents a further reduction in the sterile flowers to a more bract-like structure. Perhaps the hairs in the female inflorescence provide some protection of the few scattered fruits from potential predators. The structure of the inflorescence is in need of further study in this species.

There is now no type material of *Pimelea gilgiana* at B. Presumably the B syntype collected by Diels was lost when the bulk of that herbarium was destroyed.

Sect. 2. **Pimelea**

Pimelea a. *Eupimelea* Endl., nom. illegit., Gen. Pl. Suppl. 4: 61 (1848). — *Pimelea* sect. *Eupimelea* Meissner, nom. illegit. in DC., Prodr. 14: 497 (1857). — *Pimelea* subgen. *Eupimelea*

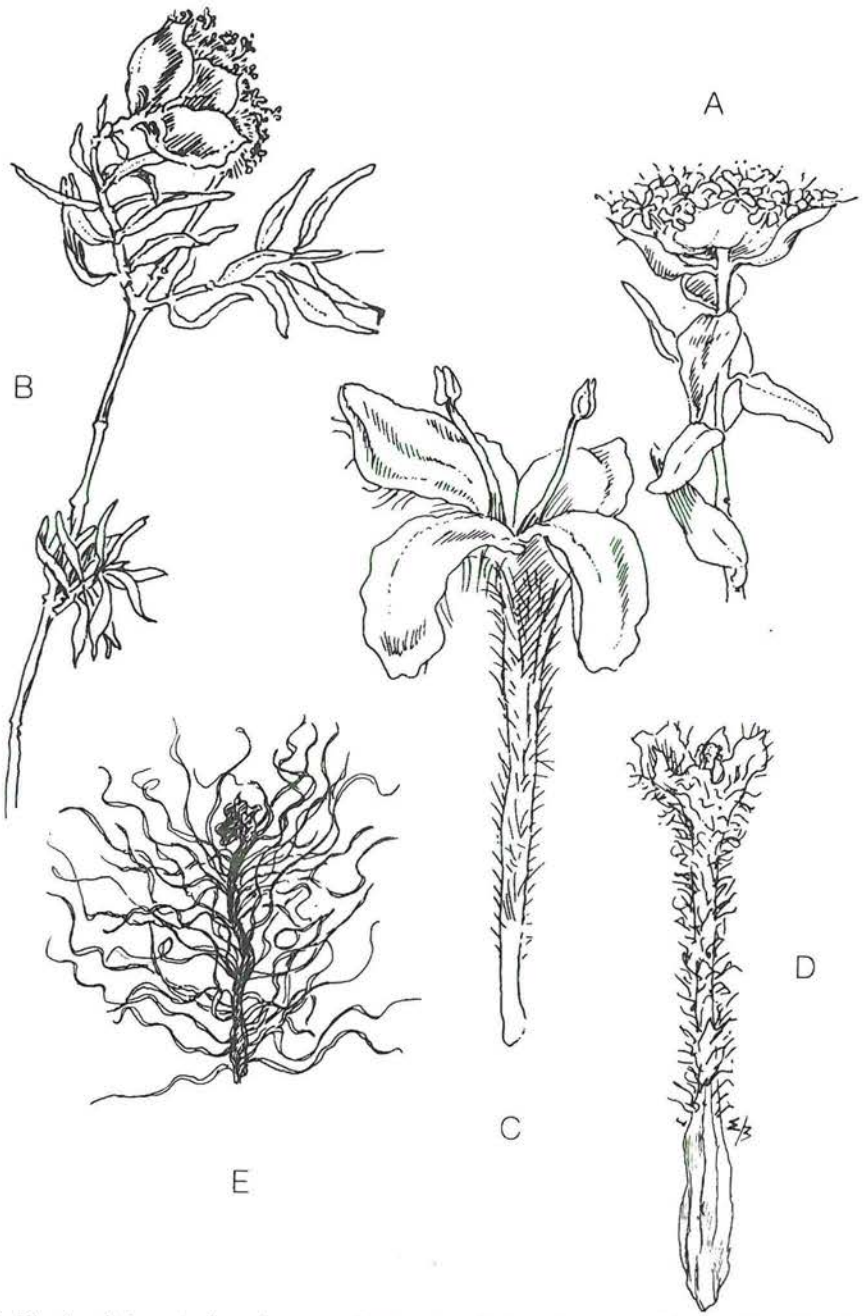

Figure 2. *Pimelea gilgiana*. A- flowering stem of male plant; B- flowering stem of female plant; C- male flower (x 10); D- female flower (x 12); E- sterile flower from female head (x 12). Drawn from *R.J. Cranfield* 4003 (A, C) and *J.S. Beard* 6917 (B, D, E).

Gilg, nom. illegit. sect. *Autopimelea* Gilg, nom. illegit. in A. Engler & K. Prantl, Nat. Pflanzenfam. III, 6a: 243 (1894). — *Banksia* sect. *Pimelea* (Banks & Sol. ex Gaertner) Kuntze in T. Post & Kuntze, Lex. Gen. Phan. 59 (1903).

Banksia Forster & G. Forster, Char. Gen. Pl. 7, t. 4 (1775), nom. rej., non Linn. f. (1782), nom. cons. — *Cookia* J. Gmelin, nom. illegit., Syst. Nat. 2: 24 (1791). — *Banksia* sect. *Typobanksia* Kuntze, nom. illegit. in T. Post & Kuntze, Lex. Gen. Phan. 59 (1903). *Type: P. gnidia* (Forster & G. Forster) Willd. (as *Banksia gnidia* Forster & G. Forster in the former genus and as *Cookia gnidia* (Forster & G. Forster) J. Gmelin in the latter genus) (lecto, fide S. Threlfall, Brunonia 5: 118 (1983)).

Pimelea d. *Choristachys* Endl., Gen. Pl. 331 (1837). — *Calyptrostegia* B. *Choristachys* (Endl.) Endl., Gen. Pl. Suppl. 4: 61 (1848). — *Pimelea* sect. *Choristachys* (Endl.) F. Muell., Fragm. 4: 49 (1863). — *Pimelea* sect. *Calyptrostegia* subsect. *Choristachys* (Endl.) Benth., Fl. Austral. 6: 21 (1873). — *Banksia* sect. *Typobanksia* c. *Choristachys* (Endl.) Kuntze in T. Post & Kuntze, Lex. Gen. Phan. 60 (1903). *Type: P. spicata* R. Br.

Gymnococca Fischer & C. Meyer, Index Sem. Hort. Petrop. 10: 46 (1845). — *Gymnococca* I. *Melanococca* C. Meyer, nom. illegit., loc. cit. — *Pimelea* sect. *Gymnococca* (Fischer & C. Meyer) Meissner in DC., Prodr. 14: 514 (1857). *Type: P. drupacea* Labill. (as *G. drupacea* (Labill.) Fischer & C. Meyer).

Pimelea sect. *Eupimelea* 5. *Micranthae* Meissner in DC., Prodr. 14: 510 (1857). *Type: P. serpyllifolia* R. Br. (lecto designated here).

Pimelea sect. *Dithalamia* Benth., Fl. Austral. 6: 26 (1873). — *Banksia* sect. *Dithalamia* (Benth.) Kuntze in T. Post & Kuntze, Lex. Gen. Phan. 60 (1903). *Type: P. elachantha* F. Muell. (= *P. hewardiana* Meissner) (lecto, fide S. Threlfall, Brunonia 5: 156 (1983)).

Undershrubs to *tall shrubs,* dioecious or rarely (not in Western Australia) hermaphrodite or (not in Australia) gynodioecious. *Stems* glabrous or hairy; nodes prominent, c. twice as thick as petiole. *Leaves* shortly petiolate or subsessile. Sessile *involucral bracts* sometimes present, minute or leaf-like. *Inflorescence* compact or rarely interrupted-elongate at maturity, erect, 1-many-flowered; rachis slender or enlarged. *Pedicels* hairy or glabrous. *Female or bisexual flowers* (in Western Australia): floral tube small, the ovary-portion longer than style-portion, usually splitting irregularly at base as fruit expands and tardily shed, sometimes persistent, rarely circumscissile above ovary. *Sepals* spreading. *Stamens* 2 or (not in Western Australia) very rarely 1; connective narrower than anther; slits semi-lateral to lateral or very rarely (not in Western Australia) more or less adaxial after dehiscence. *Fruit* succulent or dry.

A section of 36 species, 18 species endemic to Australia, 1 species endemic to Lord Howe Island and, according to Mark and Adams (1973), 17 species endemic to New Zealand and Chatham Island. The Australian species are widespread, occurring in all states and in habitats ranging from alpine to desert.

Notes. All the extra-Australian members of the genus belong to this section. They appear to be similar to Australian species except that they are predominently gynodioecious and the flowers are more commonly elongate than in Australian species. The type species from New Zealand, *Pimelea prostrata,* is very similar to Australian species. An illustration of *P. prostrata* in Moore and Irwin (1978: 63) shows, in addition to the flowers, a succulent fruit with the floral tube irregularly split at the base. Sect. *Pimelea* is the only group in which the fruit is sometimes succulent and the only group, apart from the monotypic sect. *Heterantheros,* that includes species with floral tubes splitting in this manner.

Pimelea spiculigera and *P. forrestiana* appear to link sect. *Pimelea* to sect. *Epallage* and could be placed instead in the latter section. The tendency shown by the inflorescence to elongate and become interrupted in fruit is common in sect. *Epallage* but unknown in other

members of sect. *Pimelea*. However, the dioecy, glabrous flowers and persistent floral tube of the two species are more typical of sect. *Pimelea*. Furthermore, in their vegetative characters, *P. forrestiana* and *P. spiculigera* are difficult to distinguish from *P. microcephala*, a more typical member of sect. *Pimelea*.

In eastern Australia, *Pimelea petrophila* and *Pimelea flava* are somewhat intermediate between sect. *Pimelea* and sect. *Calyptrostegia* but appear to be best placed in sect. *Pimelea* because their bracts are shortly petiolate.

2. **Pimelea serpyllifolia** R. Br., Prodr. 360 (1810). — *Banksia serpyllifolia* (R. Br.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* Bay 4 [Petrel Bay, Isle of St Francis], South Australia, 3 Feb. 1802, *R. Brown* (BM).

Description as for *Pimelea serpyllifolia* subsp. *occidentalis* below but stems sometimes glabrous.

Distribution. (Figures 5, 7.) In Western Australia extends along the south coast from Israelite Bay to the South Australian border. Also occurs in South Australia, Victoria, Tasmania and New South Wales.

Affinities. Closest to *Pimelea halophila*, also showing affinities to the eastern Australian species *P. hewardiana*.

Notes. Two subspecies are recognised.

Key to Subspecies

1. Stems glabrous. Flowers usually glabrous inside.....2a. subsp. *serpyllifolia*
1. Stems hairy for a few internodes below each inflorescence. Flowers at least sparsely hairy inside.....2b. subsp. *occidentalis*

2a. subsp. **serpyllifolia**

Pimelea cluytioides Meissner in Lehm., Pl. Preiss. 2: 271 (1848). — *Calyptrostegia cluytioides* (Meissner) Walp., Annales Botanices Systematicae 3: 324 (1852). *Type:* Port Phillip, Victoria, 1843, *C.J. Latrobe* (holo vel iso: NEU, n.v., fide S. Threlfall, Brunonia 5: 163 (1983)).

In Western Australia this subspecies is known only from Eucla and is as described for the other subspecies except that the stems are glabrous. For a description of this subspecies in eastern Australia see Threlfall (1983:163).

Specimens examined. WESTERN AUSTRALIA (selected from 6 seen): Eucla, 1 Sept. 1963, *M.E. Phillips* (NSW).

SOUTH AUSTRALIA (selected from over 280 seen): c. 3.5 km S of Kingscote, Kangaroo Island, *H. Eichler* 15252 (AD, BRI, CANB); lower Coorong, 20 km S of Salt Creek, *D.E. Symon* 10416 (ADW).

NEW SOUTH WALES: 23 mi [37 km] W of Euston, 18 Feb. 1955, *T. & J. Whaite* (NSW).

VICTORIA (selected from c. 50 seen): Bellarine Peninsula, Barwon area, 2 Jan. 1983, *J.C. Kissane* (PERTH); Rye, *J.H. Ross* 2528 (AD, MEL);

TASMANIA (selected from c. 30 seen): King Island, 26 Aug. 1951, *E. Smith* (HO, PERTH); East Sister Island, *J.S. Whinray* 52, 392 (AD, HO).

Distribution. (Figure 7.) Occurs at Eucla (31°43' S 128°54' E), in south-eastern South Australia, most of Victoria and on islands of the Bass Strait (Tasmania), with one record from the extreme south-west of New South Wales.

Notes. Threlfall (1983: 164) noted the occurrence of a stunted spinescent variant on basaltic plains in Victoria. This variant appears to be a new species.

2b. subsp. **occidentalis** Rye, subsp. nov.

Differt a *P. serpyllifolia* R. Br. subsp. *serpyllifolia* indumento in internodiis nonnullis infra inflorescentiam et in facie interiore tubi floralis evoluto.

Typus: 10 km S of Point Dover, Western Australia, 4 Sept. 1968, *P.G. Wilson* 7697 (holo: PERTH; iso: CANB, K, MEL).

Differs from *P. serpyllifolia* R. Br. subsp. *serpyllifolia* in being hairy on a few internodes below each inflorescence and in being hairy inside the floral tube.

Shrub, erect or sometimes (in exposed situations) almost prostrate, 0.1-1 m high, up to 2 m broad, single-stemmed at ground level, many-branched and bushy above. *Stems* usually dark brown near each inflorescence and then dark grey to black, becoming medium to pale grey further from apex, sparsely to moderately hairy near each inflorescence, soon becoming glabrous further from apex; hairs 0.1-0.3 mm long. *Leaves* opposite, crowded, patent or antrorse, glabrous; petiole up to 0.4 mm long; lamina concolorous, pale to medium green or grey-green, narrowly elliptic to broadly elliptic or broadest slightly above the middle within the same length/width ratios, 1-6 x 0.7-2.5 mm, flat or slightly concave on adaxial surface, recurved and with an abaxial mucro at apex, acute to obtuse. *Peduncle* up to 1 mm long. *Involucral bracts* 2 or 4, leaf-like in colour, obovate to broadly obovate, 2.5-6 x 2.2-3.5 mm, glabrous. *Inflorescence* terminal but sometimes appearing axillary when on a very short lateral branchlet, compact, usually 4-12-flowered. *Pedicels* usually 0.3-0.7 mm long, densely hairy; longest hairs 0.6-1 mm long. *Flowers* white to yellow or greenish yellow, usually cream. *Floral tube of male flowers* 2-2.5 mm long, slender at base, 0.5-0.8 mm diam. at summit, glabrous outside or rarely with a few patent hairs 0.1-0.3 mm long near base, hairy inside but sometimes only sparsely so, often very densely hairy at base, more sparsely hairy above and glabrous in distal 0.5-1 mm; hairs mostly patent, somewhat curled and tangled, 0.1-0.3 mm long. *Floral tube of female flowers* scarcely continued above ovary, 2-2.5 x 1-1.5 mm, 0.8-1.2 mm diam. at summit, persistent in fruit or tardily splitting at base, glabrous outside, hairy throughout inside; hairs antrorse or patent, somewhat curled and tangled, 0.2-0.5 mm long. *Sepals* broadly ovate or ovate, 0.8-1.3 mm long, incurved at apex, glabrous. *Stamens* shorter than sepals; filament 0.5-0.8 mm long; anther 0.4-0.6 x 0.25-0.3 mm; slits semi-lateral after dehiscence. *Staminodes* of female flowers: filament 0.05-0.3 mm long; anther 0.15-0.4 x 0.1-0.2 mm. *Ovary* c. 1 mm long, with an apical tuft of hairs 0.1-0.8 mm long, glabrous below. *Style* exserted by 1-1.5 mm; stigma brush-like. *Pistillode* absent or < 0.5 mm long in male flowers. *Fruit* not seen at maturity, presumably dry.

Specimens examined. WESTERN AUSTRALIA: Israelite Bay, Sept. 1915, *J.P. Brookes* (NSW); Twilight Cove, *A.S. George* 8554 (PERTH); 15 km S of Cocklebiddy, *A.S. George* 11846 (PERTH); c. 27 km S of Caiguna, *R. Parsons* 191 (AD); near Point Dover, *P.G. Wilson* 5913 (PERTH); c. 30 km SW of Caiguna, *P.G. Wilson* 5968 (PERTH); 10 km N of Point Dover, *P.G. Wilson* 7696 (PERTH); 17 km S of Caiguna, *E. Wittwer* 1974 (PERTH).

Distribution. (Figures 5, 7.) Extends along the coast from Israelite Bay (33°37' S, 123°52' E) to Twilight Cove (32°19' S, 126°03' E).

Habitat. Occurs in limestone areas close to the coast.

Flowering period. July-November.

Derivation of name. Occidentalis (L.) — western, referring to its occurrence in the western part of the species range.

3. **Pimelea halophila** Rye, sp. nov. (Figure 3.)

Affinis *P. serpyllifoliae* R. Br. sed foliis alternis minoribus, floribus extus tantum pilosis et ovario in floribus femineis glabro diversa.

Typus: Lake King salt lake, Western Australia, 4 Oct. 1982, *B.L. Rye* 82035A (holo: PERTH, iso: CANB, K, MEL).

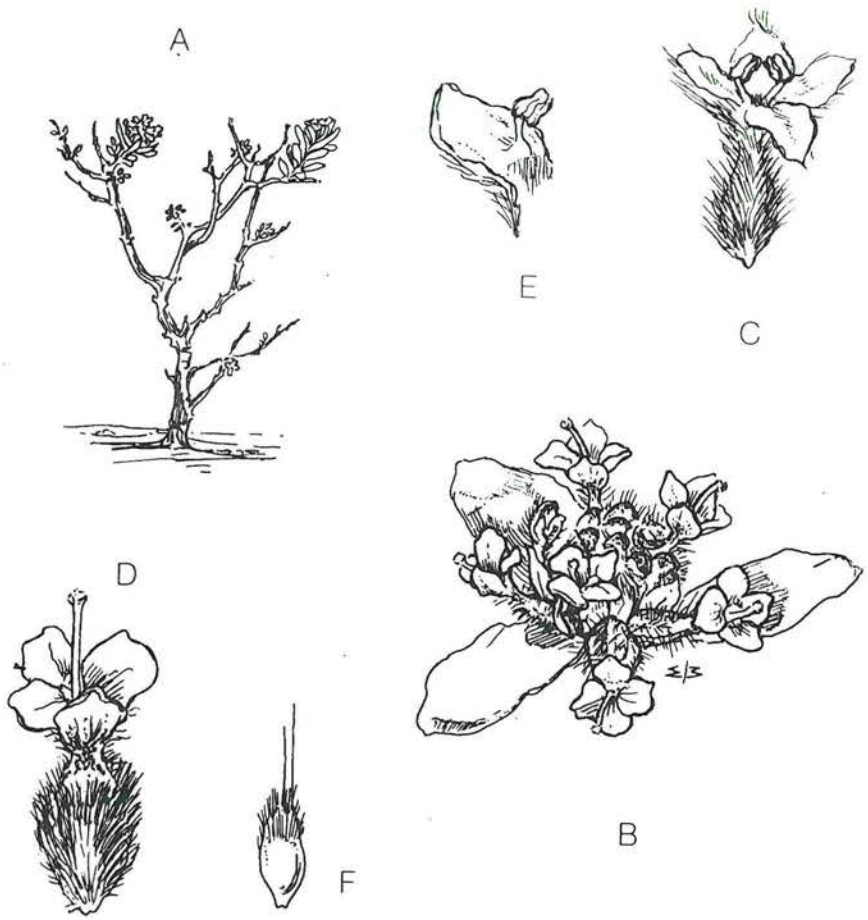

Figure 3. *Pimelea halophila.* A- small flowering female plant; B- female inflorescence and bracts (x 5); C- male flower (x 7.5); D- female flower (x 12); E- stamen (x 10); F- ovary (x 12). Drawn from fresh material collected at type locality.

Related to *P. serpyllifolia* R. Br. but differs in the alternate and smaller leaves, in being densely hairy on the outside of the flowers and in the glabrous ovary of female flowers.

Undershrub, 15-150 mm high, the main stem often buried and giving rise to a number of main branches appearing at ground level and forming a cushion. *Stems* yellow-green near each inflorescence, becoming purplish then grey further from apex, glabrous. *Leaves* alternate, patent or antrorse, glabrous; petiole up to 0.3 mm long; lamina concolorous, medium green to bluish green, usually more or less elliptic (often broadly elliptic to almost circular in the smallest leaves), 0.4-3.2 x 0.4-1.5 mm. *Peduncle* 0.5 mm long. *Involucral bracts* usually 4, sometimes 3, similar in colour and length to the uppermost leaves but up to 1.7 mm wide, sparsely hairy on the central part inside, otherwise glabrous. *Inflorescence* terminal, compact, 4-20-flowered. *Pedicels* 0.2-0.4 mm long; hairs up to 0.4 mm long in male flowers, up to 0.8 mm long in female flowers. *Flowers* glabrous inside floral tube and sepals; floral tube usually pink in style-portion; sepals white or cream, ovate, with an indumentum similar to that of floral tube but usually less dense, especially in female flowers. *Male flowers:* tube 2-2.5 mm long, cylindric but often swollen in basal 1-1.5 mm, densely covered by antrorse to patent hairs up to 0.5 mm long, the indumentum sometimes more dense in the swollen portion than above; sepals 1-1.3 mm long; stamens shorter than sepals, the filament 0.4-0.8 mm long and anther 0.4-0.5 x c. 0.3 mm, the connective narrow, the slits lateral after dehiscence; pistillode with an ovary c. 0.5 mm long and with terminal hairs up to 0.6 mm long, the style c. 0.5 mm long. *Female flowers:* tube 1.5-1.7 mm long, the ovary-portion c. 1 x 1 mm and style-portion c. 0.6 mm long, with a very dense indumentum of antrorse to patent hairs up to 0.6 mm long; sepals 0.6-0.7 mm long; staminodes with a virtually sessile anther up to 0.1 x 0.1 mm; ovary c. 0.8 mm long, glabrous; style exserted by c. 1 mm, the stigma brush-like. *Fruit* dry. *Seed* c. 2 x 1 mm, with faint longitudinal markings.

Specimens examined. WESTERN AUSTRALIA: Lake King, *A.S. George* 10976 (PERTH); Lake King salt lake, *B.L. Rye* 82935B (CANB, K, MEL, PERTH); cultivated in Perth ex Lake King, *B.L. Rye* 84002 (PERTH); middle of Lake King causeway, *R.A. Saffrey* 574 (PERTH).

Distribution. (Figure 5.) Known only from Lake King salt lake (33°06' S, 119°35' E).

Habitat. Occurs on islands slightly raised above the level of the salt lake, in saline whitish sand in a very low open shrubland.

Flowering period. August-October.

Conservation status. This species, known from only one salt lake, appears to be rare and endangered. The only known locality is not a nature reserve and has been subject to mining in at least one area.

Derivation of name. Halos (Gr.) — salt, *philoe* (Gr.) — to love, in reference to its saline habitat.

Affinities. As indicated in the diagnosis. Similar to the type subspecies of *Pimelea serpyllifolia* in the absence of hairs on the stems and the absence of hairs inside the floral tube but differing from the Western Australian *P. serpyllifolia* subsp. *occidentalis* in both of these characteristics.

Notes. Although the ovary of the female flowers examined was glabrous, the abortive ovary of the male flowers examined was hairy.

4. **Pimelea clavata** Labill., Nov. Holl. Pl. 1: 11 (1805). — *Banksia clavata* (Labill.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* "Capite Van-Dieman" [probably collected at Observatory Island, Esperance Bay, Western Australia], Dec. 1792, *J.J.H. de Labillardiere* (holo: FI, n.v., photo. in PERTH).

Pimelea viridula Lindb., Finsk. Vet. Soc. Forlandl. 9: 61-62, t. 60 (1867). *Type:* Illustration t. 60.

Shrub, erect, (0.3-)1-4(-6) m high, single-stemmed at ground-level, many-branched above, basically dioecious but rarely with a few female flowers on primarily male individuals. *Stems* green to greenish brown and hairy near each inflorescence, becoming medium to dark brown and glabrous further from apex; hairs appressed to patent, either all similar or some long and others much shorter, fine, the longest hairs 0.6-1.5 mm long. *Leaves* opposite, patent or antrorse; petiole 0.4-1.4 mm long, hairy; lamina discolorous, pale to medium green on abaxial surface, medium to dark green on adaxial surface, narrowly elliptic or nearly so to almost linear, (6-)11-43 x (1.5-)2-9 mm, flat or the margins recurved, more or less acute, not mucronate but with an apical tuft of hairs resembling a mucro and up to 0.5 mm long, moderately to densely hairy on abaxial surface, glabrous on adaxial surface; hairs appressed to antrorse, very fine, the longest usually 0.8-1.2 mm long. *'Peduncle'* (or length of stem between inflorescence and uppermost persistent leaves) up to 25 mm long. *Uppermost leaves* subtending inflorescence usually 2, deciduous, shortly petiolate, similar in colour, shape and vestiture to leaves below, 2-5 x 0.6-1.5 mm. *Inflorescence* terminal but often appearing almost axillary at first, compact, many-flowered. *Pedicels* 0.3-1 mm long, densely hairy; hairs 1-1.3 mm long. *Flowers* white or cream, rarely pale yellow, densely hairy outside, glabrous inside. *Male flowers:* tube 2-3.5(-4) mm long, 0.2-0.5 mm diam. at middle, expanded to 0.5-0.6 mm diam. at summit; sepals ovate-elliptic, 1.2-2 mm long; hairs (of tube and sepals) antrorse, 0.1-0.6 mm long, the longest ones, which are 0.3-0.6 mm long, either confined to sepals or on both tube and sepals; stamens shorter than sepals, the filament 0.4-0.7 mm long and anther 0.4-0.8 x 0.3-0.5 mm, the slits lateral after dehiscence; pistillode present, the aborted ovary < 1 mm long. *Female flowers:* tube 1.5-2 x c. 0.7 mm, continued 0.2-0.3 mm above ovary-portion, 0.3-0.4 mm diam. at summit, circumscissile above ovary in fruit, the portion below the circumscission point persistent; sepals elliptic or nearly so, 0.6-1.2 mm long; hairs (of tube and sepals) most densely arranged on sepals, appressed to antrorse, c. 0.3 mm long; staminodes < 0.5 mm long; ovary with an apical tuft of hairs up to 0.4 mm long; style exserted by 0.4-0.6 mm, the stigma brush-like. *Fruit* succulent, black when dried but probably dark purple when fresh, 3-4 x c. 2 mm, with a few hairs on outside of persistent base of floral tube. (Figure 4.)

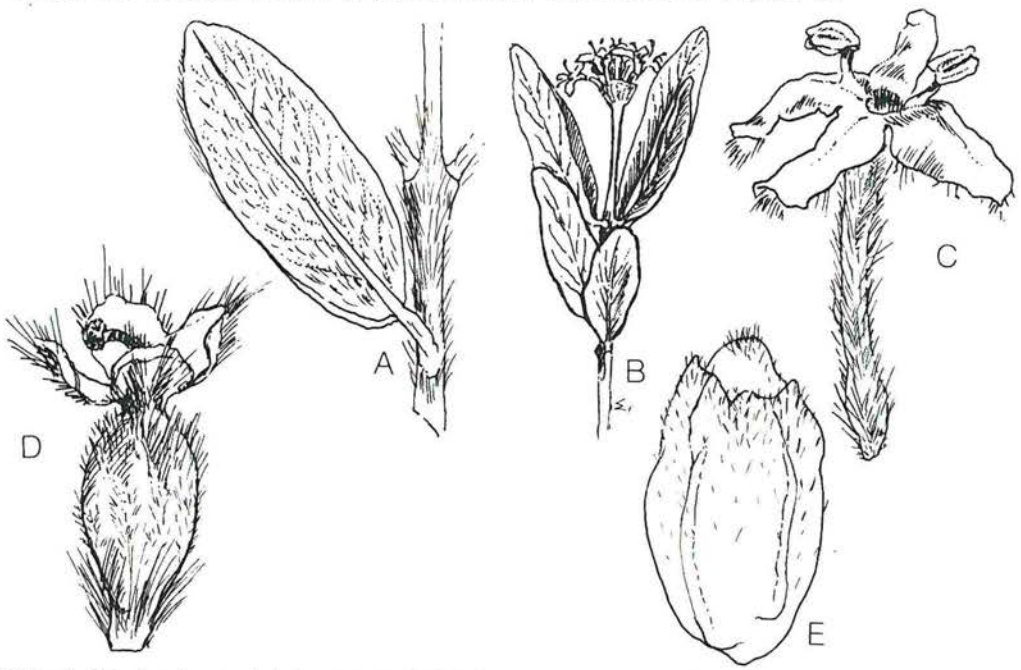

Figure 4. *Pimelea clavata*. A- hairy stem and leaf (x 2.5); B- flowering stem of female plant; C- male flower (x 15); D- female flower and pedicel (x 15); E- partly enclosed fruit (x 11). Drawn from *R.J. Cranfield* 4882a (A, C) and 4882 (B, D).

Specimens examined. WESTERN AUSTRALIA (selected from over 90 seen): Augusta, *A.M. Ashby* 2691 (AD, PERTH); North Twin Peak Island, *M.I.H. Brooker* 3618 (PERTH); Warren National Park, *E.M. Canning* 6501 (CBG); Middle Island, *A. Cunningham* 12 (BRI, MEL); Pemberton, *C.A. Gardner* 1219 (CANB, PERTH); Princess Royal Harbour, *B.T. Goadby* 1302 (PERTH); Mt Frankland, 14 Feb. 1913, *S.W. Jackson* (PERTH); Torbay, *K. Newbey* 3487 (PERTH); Peaceful Bay, *S. Paust* 370 (PERTH); 5 mi [8 km] W of Manjimup, *R.D. Royce* 2367 (PERTH); Observatory Island, *A.S. Weston* 9371 (CANB, PERTH); Middle Island, *A.S. Weston* 9869 (CANB, PERTH); Salisbury Island, 24 Nov. 1950, *J.H. Willis* (MEL); Mt Clare, Walpole, *E. Wittwer* 1153 (PERTH).

Distribution. (Figure 5.) A disjunct distribution. Extends from Margaret River (33°57' S, 115°04' E) to Bald Island (34°55' S, 118°27' E) and in the Recherche Archipelago from Observatory Island (33°55' S, 121°47' E) to Salisbury Island (34°22' S, 123°33' E).

Habitat. On the mainland the species occurs in protected areas on coastal dunes, also in Karri forest further inland, and is often associated with watercourses or ephemeral lakes. In the Recherche Archipelago *P. clavata* has been recorded from limestone cliffs.

Flowering period. Mainly September-February.

Affinities. Closest to *Pimelea microcephala.*

Notes. The known range of *P. clavata* is disjunct between Bald Island and the Recherche Archipelago, a distance of about 300 km. From Albany eastwards the species is only known from islands although, to the west of Albany, it extends inland to Manjimup. The apparent large disjunction in the range is possibly due to the shortage of large islands between Bald Island and the Recherche Archipelago. It is possible that the species would be found on Doubtful Island (34°22' S, 119°36' E) and West Island (34°05' S, 120°29' E), the only islands of any size spanning the disjunction, if these were explored.

Labillardiere erroneously gave the type location of the species as Tasmania as he did for several other species (Nelson 1974) that do not occur in Tasmania. Believing that *P. clavata* did not occur in the Recherche Archipelago, Nelson wrongly concluded that Labillardiare could not have collected the type specimen. He suggested that Leschenault may have been the collector. In fact *P. clavata* occurs, and is probably common, on islands of the Recherche Archipelago including Observatory Island, where Labillardiere apparently made his Western Australian collections.

5. **Pimelea microcephala** R. Br., Prodr. 361 (1810). — *Calyptrostegia microcephala* (R. Br.) Endl., Gen. Pl. Suppl. 4: 61 (1848). — *Banksia microcephala* (R. Br.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* Bay 4 [Petrel Bay, Isle of St Francis], South Australia, 3 Feb. 1802, *R. Brown* (BM).

Description and distribution as for *Pimelea microcephala* subsp. *microcephala.*

Affinities. Pimelea microcephala is most closely related to the eastern Australian species *P. neo-anglica.* In Western Australia the closest relative is *P. clavata.*

Notes. There are two subspecies but only the type subspecies occurs in Western Australia.

Key to Subspecies

1. Leaves green. Floral tube hairy outside.....5a. subsp. *microcephala*
1. Leaves glaucous. Floral tube glabrous.....5b. subsp. *glabra*

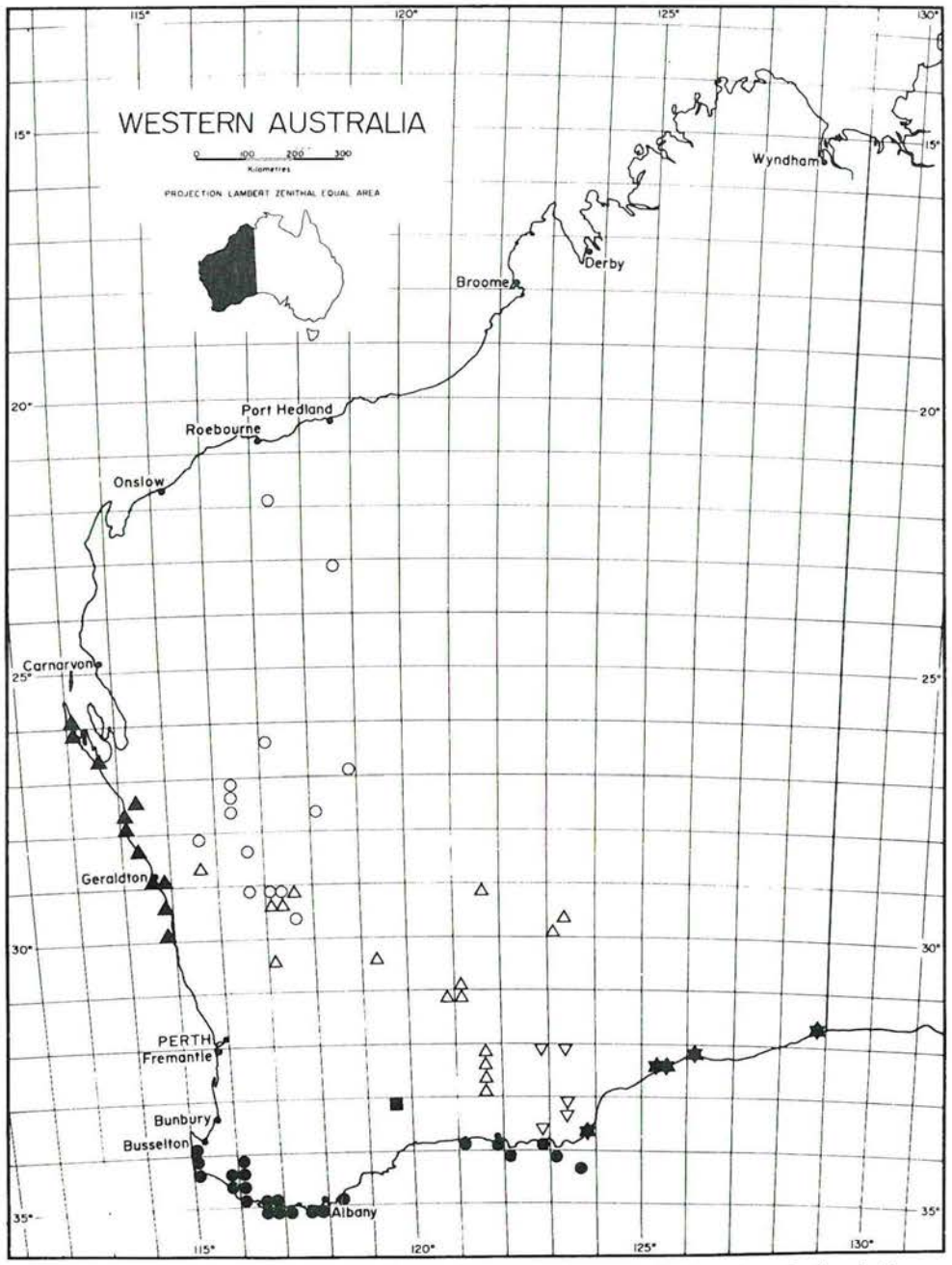

Figure 5. Distribution of *Pimelea gilgiana* ▲, *P. halophila* ■, *P. clavata* ●, *P. forrestiana* ○, *P. spiculigera* var. *spiculigera* ▽, *P. spiculigera* var. *thesioides* △ and *P. serpyllifolia* ★.

5a. subsp. **microcephala**

Pimelea microcephala var. *elongata* Meissner, Linnaea 26: 350 (1854). *Type:* South Australia, 1854, *F. Mueller* (lecto, fide S. Threlfall, Brunonia 5: 161 (1983): G-DC, n.v., microfiche seen).

Pimelea microcephala var. *linariifolia* Meissner in DC., Prodr. 14: 515 (1857). *Type:* Lachlan River, New South Wales, June 1817, *A. Cunningham* 3/1817 (lecto, fide S. Threlfall, Brunonia 5: 162 (1983): G-DC, n.v., microfiche seen).

Shrub, erect, usually 0.8-2.5 m high, single-stemmed at ground level, many-branched above. *Stems* red-brown or green near each inflorescence and then red-brown, becoming dark brown to almost black then grey further from apex, glabrous except for axillary hairs. *Leaves* opposite, antrorse or patent, glabrous; petiole 0.2-0.8 mm long; lamina concolorous, medium green, 1 usually narrowly elliptic or nearly so, (1.5-)6-25(-60) x 1-5(-7) mm, flat or slightly concave on adaxial surface, acute or narrowly obtuse, mucronulate. *Peduncle* up to 4 mm long. *Involucral bracts* 2 or sometimes 4, leaf-like in colour, narrowly ovate to ovate-elliptic, 2-15 x 1.5-6 mm, glabrous. *Inflorescence* terminal, compact, few- to many-flowered. *Pedicels* up to 0.5 mm long, rather densely hairy; hairs up to 0.6 mm long. *Flowers* white to yellow or greenish, with a dense indumentum of rather coarse hairs outside, glabrous inside. *Male flowers:* tube narrowly cylindric, 3-7 mm long, 0.4-0.5 mm diam. at summit, with curly, more or less patent hairs up to 0.7 mm long; sepals elliptic to ovate, 1.2-2 mm long, sparsely covered by hairs similar to those on tube; stamens shorter than sepals, the filament 0.7-1 mm long and anther 0.4-0.7 x 0.3-0.5 mm, the slits lateral after dehiscence; pistillode absent or < 0.5 mm long. *Female flowers* with rather tangled hairs up to 0.3 mm long; tube 1.5-2 mm long, the ovary-portion c. 1 mm diam., scarcely continued above ovary-portion, c. 0.5 mm diam. at summit, persistent in immature fruit, splitting irregularly in the ovary-portion as the fruit expands and tardily shed; sepals elliptic to ovate or broadly so, 0.2-0.9 mm long; staminodes with a subsessile anther 0.05-0.2 x 0.05-0.2 mm; ovary 1-1.5 mm long, glabrous; style exserted by 1.1-5 mm, the stigma papillose to almost brush-like. *Fruit* succulent and orange when fresh, black when dried, 4-7 x 2-4 mm, glabrous. (Figure 6.)

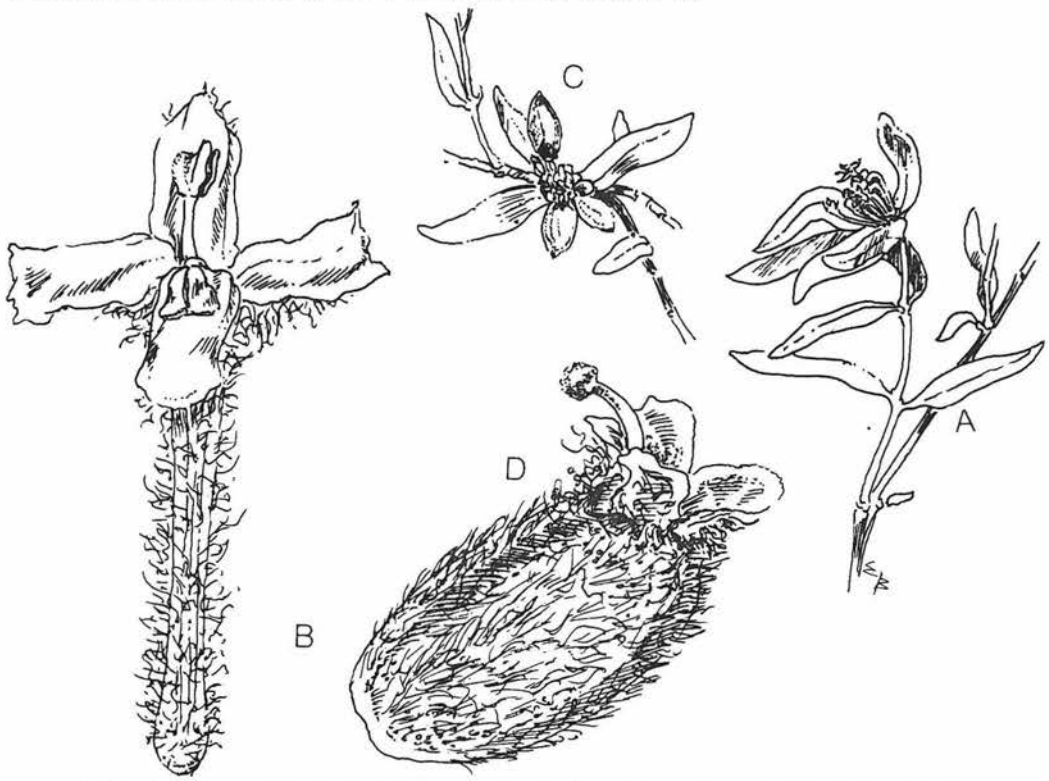

Figure 6. *Pimelea microcephala*. A- flowering stem of male plant; B- male flower (x 20); C- female inflorescence with 3 naked fruits (x 2); D- female flower (x 25). Drawn from dried material.

Specimens examined. WESTERN AUSTRALIA (selected from over 240 seen): 20 mi [32 km] NE of Yuna, *A.M. Ashby* 1585 (AD, PERTH); Mt Fredrick, *J.V. Blockley* 267 (PERTH); Southern Cross Caravan Park, *R.J. Cranfield* 1630 (PERTH); North Pool, *L.A. Craven* 5172 (BRI, NT, PERTH); c. 70 km S of Leonora, *N.N. Donner* 4527 (AD, PERTH); near Mt Singleton, *C.A. Gardner & W.E. Blackall* 25 (PERTH); 23 mi [37 km] S of Learmonth, *A.S. George* 1262 (PERTH); c. 27 km E of Terhan Rockhole, *A.S. George* 12182 (PERTH); c. 5 km SW of Kambalda, *A.A. Munir* 5268 (AD, PERTH); 28 km E of Salmon Gums, *K. Newbey* 6676 (PERTH); Ponier Rock, *K. Newbey* 7363 (PERTH); 10 mi [16 km] from Walkaway towards Strawberry, 15 Sept. 1968, *M.E. Phillips* (AD, BRI); Cunderdin Hill, *P. de Rebeira* 148 (PERTH); 10 mi [16 km] S of Belele, *N.H. Speck* 1013 (AD, BRI, CANB, NSW, PERTH).

NORTHERN TERRITORY (selected from c. 10 seen): Mt Riddock Station, *P.K. Latz* 3172 (BRI, NT).

SOUTH AUSTRALIA (selected from over 320 seen): 9 km E of Parachilna, *N.N. Donner* 76 (AD, NT); 8 mi [13 km] S of Emu, *N. Forde* 408 (AD, BRI, NSW, PERTH); entrance to Mambray Creek, *D.E. Symon* 470, 471 (ADW, PERTH).

QUEENSLAND (selected from c. 30 seen): Kindon Station, *L.S. Smith* 524 (BRI).

NEW SOUTH WALES (selected from over 100 seen): Cocopara Range, *M.D. Crisp* 7705576 (AD); 27 km NW of Tilpa, *J. Pickard* 2017 (NSW).

VICTORIA (selected from c. 20 seen): c. 2 km SE of Mt Crozier, *M.G. Corrick* 6641 & *P.S. Short* (AD, MEL, PERTH).

Distribution. (Figures 8, 9.) In Western Australia extends from North West Cape (21°47' S, 114°10' E), south to Dongara (29°15' S, 114°56' E), south-east to Ponier Rock (32°56' S, 123°30' E) and east to Reid (30°49' S, 128°25' E). Also occurs in Northern Territory, South Australia, Queensland, New South Wales and Victoria.

Habitat. Occurs in shrublands or sometimes in woodlands, usually in sand, sometimes in rocky ground or on dunes or floodplains.

Flowering period. Mainly May-October, also February-April.

Notes. The type material of this subspecies, borrowed from BM, was very poor, lacking flowers and fruits. The microfiche photographs of the lectotypes of the two varieties listed above were also poor but they appear to be of this subspecies.

5b. subsp. **glabra** (F. Muell. & Tate ex J. Black) Threlfall

Pimelea microcephala var. *glabra* F. Muell. & Tate ex J. Black, Fl. S. Australia 1st edn 3: 397 (1926). — *Pimelea glabra* (F. Muell. & Tate ex J. Black) Carolin in Jessop, Fl. Central Australia 222 (1981). *Type:* Mt Illbillie, Everard Range, South Australia, 5 June 1891, *R. Helms* (lecto, fide S. Threlfall, Brunonia 5: 162 (1983): AD, n.v.; isolecto: MEL).

For a description of this subspecies, which does not occur in Western Australia, refer to Threlfall (1983: 163).

Specimens examined. SOUTH AUSTRALIA (selected from 12 seen): Camp 4 [near Mt Illillinna], 9 June 1891, *R. Helms* (AD, MEL, NSW).

Distribution. (Figure 8.) Known only from a small area in north-western South Australia.

6. **Pimelea spiculigera** F. Muell., Fragm. 11: 46-47 (1878). — *Banksia spiculigera* (F. Muell.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* near Russell Range, Western Australia, date unknown, *A. Forrest* (holo: MEL).

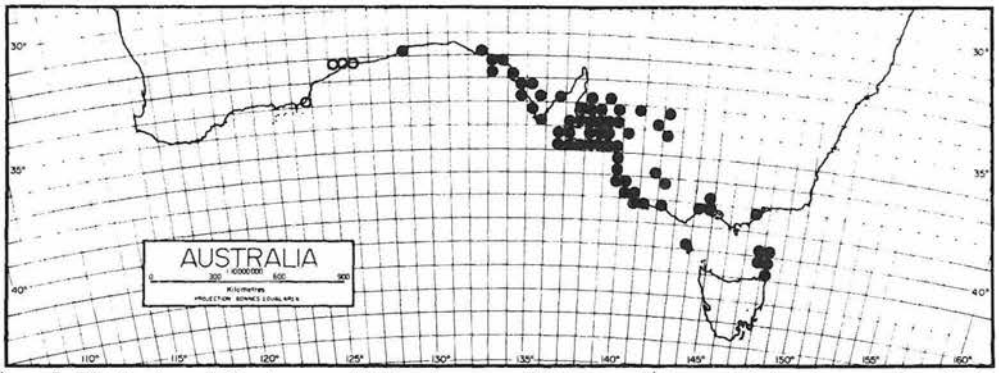

Figure 7. Distribution of *Pimelea serpyllifolia* subsp. *serpyllifolia* ● and *P. serpyllifolia* subsp. *occidentalis* ○.

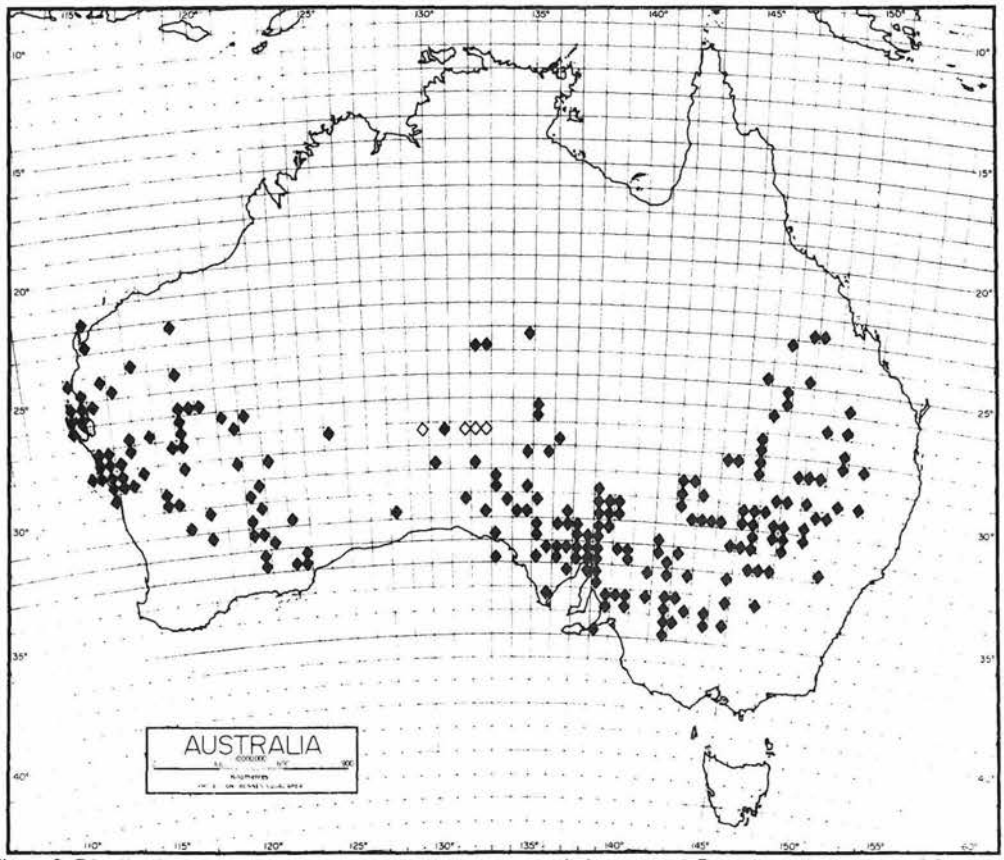

Figure 8. Distribution of *Pimelea microcephala* subsp. *microcephala* ◆ and *P. microcephala* subsp. *glabra* ◇.

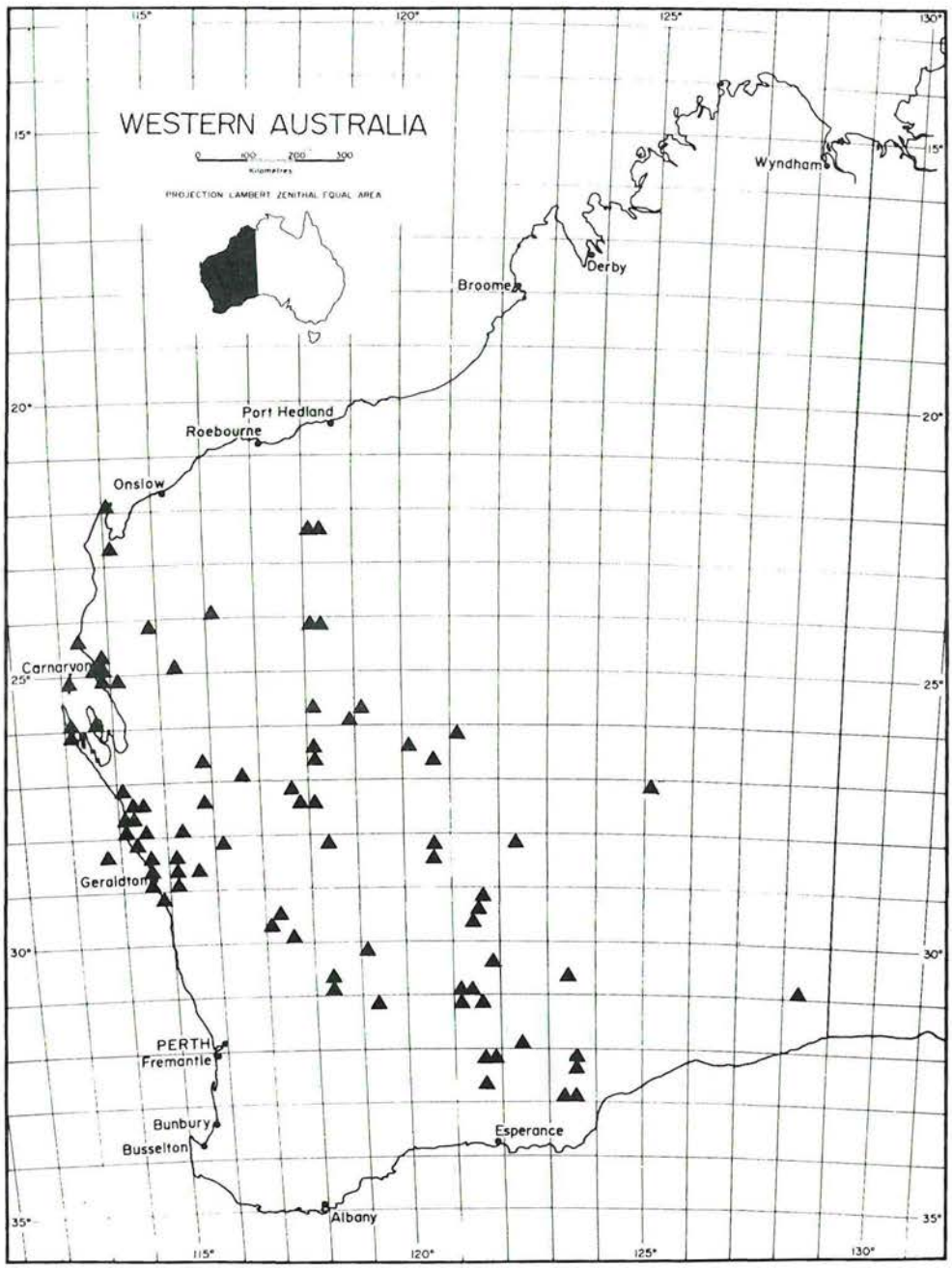

Figure 9. Western Australian distribution of *Pimelea microcephala*.

Shrub, erect, (0.2-)0.3-1(-2) m high, single-stemmed at base, often rather open above. *Stems* pale green to pale yellow-brown near each inflorescence, becoming dark red-brown then medium grey further from apex, glabrous except for axillary hairs. *Leaves* opposite, usually distant, antrorse to reflexed, usually patent, glabrous; petiole 0.3-1.3 mm long; lamina concolorous, medium green, linear or narrowly ovate to narrowly obovate, 4-26 x 0.7-3.5 mm, obtuse to acute, not mucronate. *Inflorescence* usually of 1 head or spike, rarely of more than 1 head or spike as in *Pimelea forrestiana,* each head or spike terminal on a branch or a short leafy branchlet and subtended by involucral bracts. *Involucral bracts* 2 or sometimes 4, sessile, the same colour as leaves, ovate to narrowly ovate or very rarely linear, 2-10(-13) x (1.2-)1.5-3 mm, glabrous. *Inflorescence* compact at first, sometimes becoming elongate and interrupted at maturity, many-flowered; rachis 1-11 mm long at maturity, with up to 2 mm between each group of flowers or fruits. *Pedicels* 0.3-0.7 mm long, densely hairy; longest hairs 0.5-1 mm long. *Flowers* yellow or sometimes greenish yellow, completely glabrous. *Male flowers:* floral tube 3-5.5 mm long, c. 0.3 mm diam. near middle, 1-1.3 mm diam. at summit; sepals ovate-elliptic or broadly so, 1.3-1.7 mm long; stamens shorter than sepals, the filament 0.6-1 mm long and anther c. 0.6 x 0.3-0.4 mm, the slits semi-lateral after dehiscence; pistillode absent. *Female flowers:* tube 2-3 x 0.7-0.8 mm, continued only 0.2-0.3 mm above ovary-portion, c. 0.5 mm diam. at summit, persistent in fruit; sepals becoming erect in fruit, elliptic-ovate, 0.8-1 mm long; staminodes sessile, more or less globular, up to 0.1 mm long; ovary c. 2 mm long, glabrous; style exserted by 1-1.7 mm, the stigma brush-like. *Fruit* dry. *Seed* 3-5.5 x 1-1.3 mm, with a prominent pattern of irregular transverse ridges. (Figure 10.)

Distribution. (Figure 5.) Extends from near Mullewa east to Cundeelee and south-east to near Mt Beaumont.

Flowering period. July-October.

Affinities. Very similar to *Pimelea forrestiana.* Apart from the differences indicated in the key, *P. spiculigera* has a fruiting stipe about 0.5 mm long whereas in *P. forrestiana* the fruiting stipe is 1-2 mm long. Both species can be distinguished from other Western Australian members of sect. *Pimelea* by their distinctly curved fruit, with the adaxial surface convex. The floral tube is clear-translucent in fruit. Whereas the mature inflorescence of *P. forrestiana* is elongate and interrupted, the inflorescence of *P. spiculigera* var. *thesioides,* which overlaps in range with *P. forrestiana,* is compact. *Pimelea spiculigera* var. *spiculigera,* which occurs south of the range of *P. forrestiana,* has an elongate mature inflorescence but the maximum length of the spike is only about half as long as in *P. forrestiana.*

Notes. The two varieties of *P. spiculigera* are can only be distinguished when in late flower or fruit. They are not considered to be sufficiently distinct to be regarded as subspecies because they differ in only one character. It is not known whether or not they intergrade in this character or whether they show a complete geographical separation because some specimens are not sufficiently advanced in flowering to be definitely identified. Specimens occurring in the northern part of the range were assumed to be of var. *thesioides* even when they were only in the early stages of flowering.

It is unfortunate that the name *spiculigera* has been applied to the species because the more common and widespread variety has a compact inflorescence rather than a spike-like inflorescence. The epithet *spiculigera* was first published by Bentham (1873: 23) as the nomen nudum *Pimelea spiculigera* F. Muell. ex Benth. Although the specimen cited was reportedly collected at Lake Muir, Western Australia, by J.R. Muir, it is actually *Pimelea spicata,* an eastern Australian species. Lake Muir, in the extreme south-west of Western Australia, is well outside the ranges of both *P. spiculigera* and *P. spicata.* The two species are similar in having small, glabrous or nearly glabrous flowers in an inflorescence that tends to be interrupted-elongate at maturity.

Key to Varieties

1. Mature inflorescence compact, not interrupted.....6a. var. *thesioides*
1. Mature inflorescence elongate, often interrupted.....6b. var. *spiculigera*

6a. var. **thesioides** (S. Moore) Rye, comb. nov. (Figure 10.)

Pimelea thesioides S. Moore, J. Linn. Soc. Bot. 34: 224-225 (1899). *Type:* between Coolgardie and Lake Darlot, Western Australia, 1895, *S.M. Moore* (lecto here designated, female: BM; isolecto: NY; syn, male: BM; isosyn: NY).

Inflorescence (or rarely inflorescence unit) compact, not interrupted; rachis 1-2 mm long.

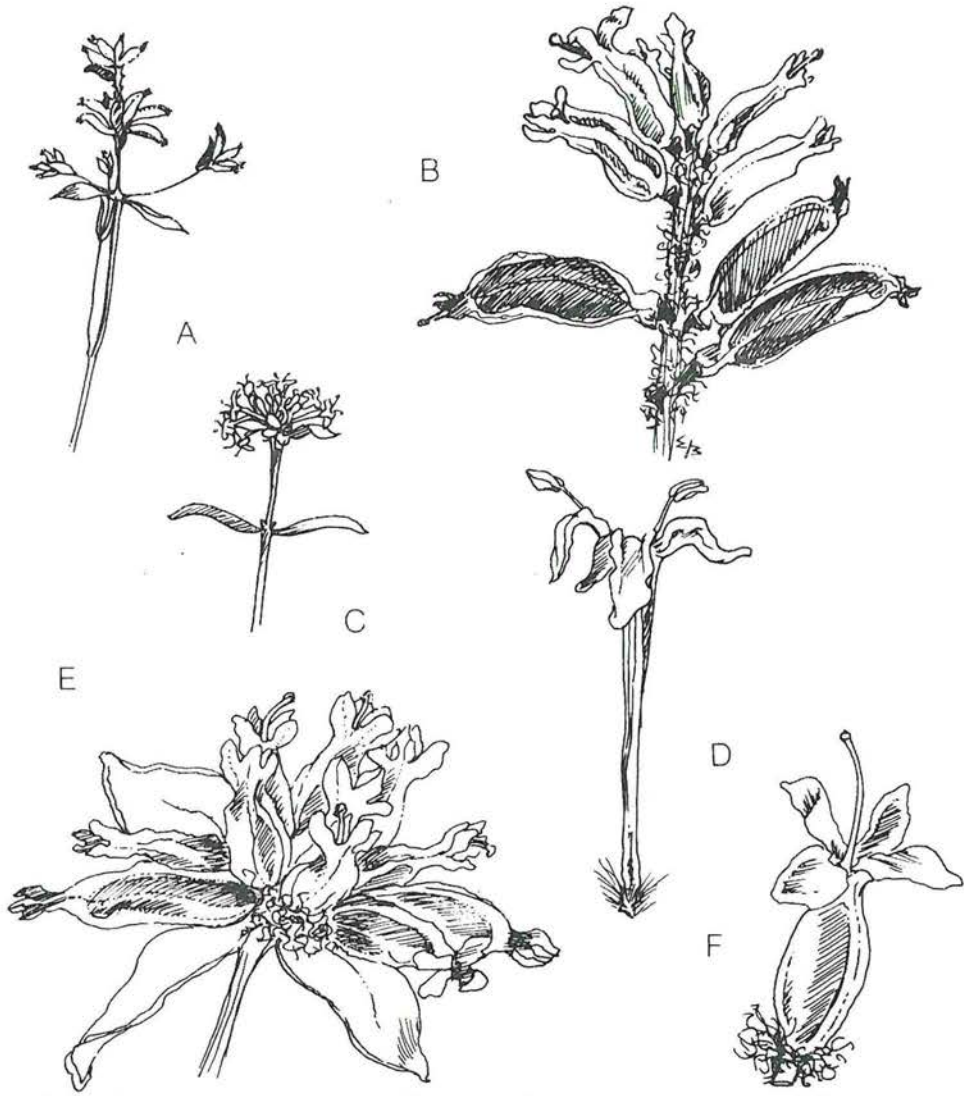

Figure 10. *Pimelea spiculigera* var. *spiculigera*. A- flowering and fruiting stem of female plant; B- female inflorescence with flowers and fruits (x 5). *P. spiculigera* var. *thesioides*. C- flowering stem of male plant; D- male flower and pedicel (x 10); E- female inflorescence with flowers and fruits (x 6.5); F- female flower and pedicel (x 8.5). Drawn from *P.G. Wilson* 10026 (A, B), *H. Demarz* 3811 (C, D) and *P.G. Wilson* 7179 (E, F).

Specimens examined. WESTERN AUSTRALIA (selected from over 30 seen): Mt Jackson, *J.S. Beard* 4755 (PERTH); 30 mi [48 km] S of Paynes Find, *J.V. Blockley* 507 (CANB); Glenorn Station, Aug. 1938, *N.T. Burbidge* (PERTH); near McPherson Rock, *M.D. Crisp* 976 (CBG); Mt Singleton, *C.A. Gardner* 12129 (PERTH); 32 mi [51 km] E of Karonie, *A.S. George* 5911 (PERTH): 7 mi [11.5 km] E of Mullewa, *J.W. Green* 1576 (PERTH); Kumarl, *L.A. Horbury* 114 (PERTH); Watheroo Rabbit Fence, *M. Koch* 1580 (MEL); 15 mi [24 km] S of Coolgardie, *R. Melville* 4075 & *D. Kemsley* (MEL, PERTH); Lake Moore, *A. Robinson* 1 (PERTH); 5 mi [8 km] N of Norseman, *R.D. Royce* 3474 (PERTH); near Gibraltar, *P.G. Wilson* 7178 (PERTH).

Distribution. (Figure 5.) Extends from near Mullewa (28°31' S, 115°35' E) south-east to Kumarl (32°47' S, 121°33' E) and Cundeelee (30°44' S, 123°25' E). Possibly also extends to Fraser Range (*T.E.H. Aplin* 1789, PERTH) and Mt Ragged (*M.A. Clements* 2031, CBG) but flowering in these specimens is not advanced enough to be sure of the variety involved.

Habitat. Occurs on granite outcrops and lateritic ridges, usually in shallow sand or sandy clay.

Flowering period. July-September.

6b. var. **spiculigera**

Pimelea microcephala var. *psilantha* F. Muell., Fragm. 11: 47 (1878). *Type:* Fraser Range, Western Australia, date unknown, *A. Dempster* (lecto here designated, female: MEL; isolecto: BM; syn, male: MEL; isosyn: BM).

Inflorescence (or rarely inflorescence unit) compact at first, becoming elongate and often interrupted at maturity; rachis up to 11 mm long. (Figure 10.)

Specimens examined. WESTERN AUSTRALIA: Southern Hills Station, *J.S. Beard* 6298 (PERTH); Fraser Range, *R. Filson* 217 (MEL, PERTH); near Russel Range, date unknown, *E.A. Forrest* (MEL); 2 km NW of Mt Pleasant, Fraser Range, *K. Newbey* 7543 (PERTH); 115 km ENE of Esperance, *R.A. Saffrey* 1258, 1259 (PERTH); Fraser Range, 6 Sept. 1963, *J.H. Willis* (MEL); c. 100 km E of Esperance and 50 km N of the coast, *P.G. Wilson* 10026, 10027 (PERTH); c. 52 mi [83 km] S of Balladonia, *P.G. Wilson* 10109 (PERTH).

Distribution. (Figure 5.) Extends south from the Fraser Range (c. 32°00' S, 122°50' E) to near Mt Beaumont (c. 33°22' S, 122°41' E).

Habitat. Occurs on granite outcrops, also recorded on gravelly soil.

Flowering period. August-October.

7. **Pimelea forrestiana** F. Muell., Fragm. 11: 46 (1878). — *Banksia forrestiana* (F. Muell.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* Mt Pyrton, Hamersley Range, Western Australia, date unknown, *J. Forrest* (lecto here designated, female: MEL; syn, male: MEL).

Shrub, erect, (0.3-)0.5-1.5 m high, single-stemmed at base, many-branched but often rather open above. *Stems* yellowish green or yellowish brown near each inflorescence, becoming dark red-brown then medium grey further from apex, glabrous except for axillary hairs. *Leaves* opposite, usually distant, patent or antrorse, glabrous; petiole 0.6-2.3 mm long; lamina concolorous, medium green or darker green, linear to narrowly elliptic or nearly so, (6-)9-40 x 1.5-6 mm, flat or adaxially concave, acute, mucronate. *Inflorescence* commonly of several spike-like units and appearing branched, 1 terminal and (1)2 pedunculate 'spikes' arising in

the axils of the uppermost (leaf or) pair of leaves, which are petiolate and not bract-like. *Peduncles* up to 3 mm long in male plants, up to 8 mm long in fruit. *Involucral bracts* absent or 1 per spike, early-deciduous, ovate, commonly translucent yellow-brown with much darker veins, 1.5-2 x 0.5-1 mm, glabrous. *'Spikes'* compact at first, soon becoming elongate and interrupted, many-flowered; rachis usually 5-25 mm long at maturity, with up to 3 mm between groups of flowers or fruits. *Pedicels* 0.1-0.4 mm long, glabrous. *Male flowers* yellow, completely glabrous; floral tube narrowly cylindric to cylindric (except at summit), 3-6.5 mm long, 0.2-0.3 mm diam. near middle, 0.7-1.2 mm diam. at summit; sepals ovate to broadly ovate, 1.2-1.8 mm long; stamens shorter than sepals, the filament 0.7-1 mm long and anther 0.8-1 x 0.3-0.5 mm, the slits semi-lateral after dehiscence; pistillode absent. *Female flowers* not seen except in fruit, probably similar to those of *Pimelea spiculigera;* floral tube persistent in fruit; sepals erect in fruit, c. 0.6 mm long, tardily shed from floral tube. *Fruit* dry. *Seed* c. 5 x 1.5 mm, with a prominent pattern of irregular transverse ridges. (Figure 11.)

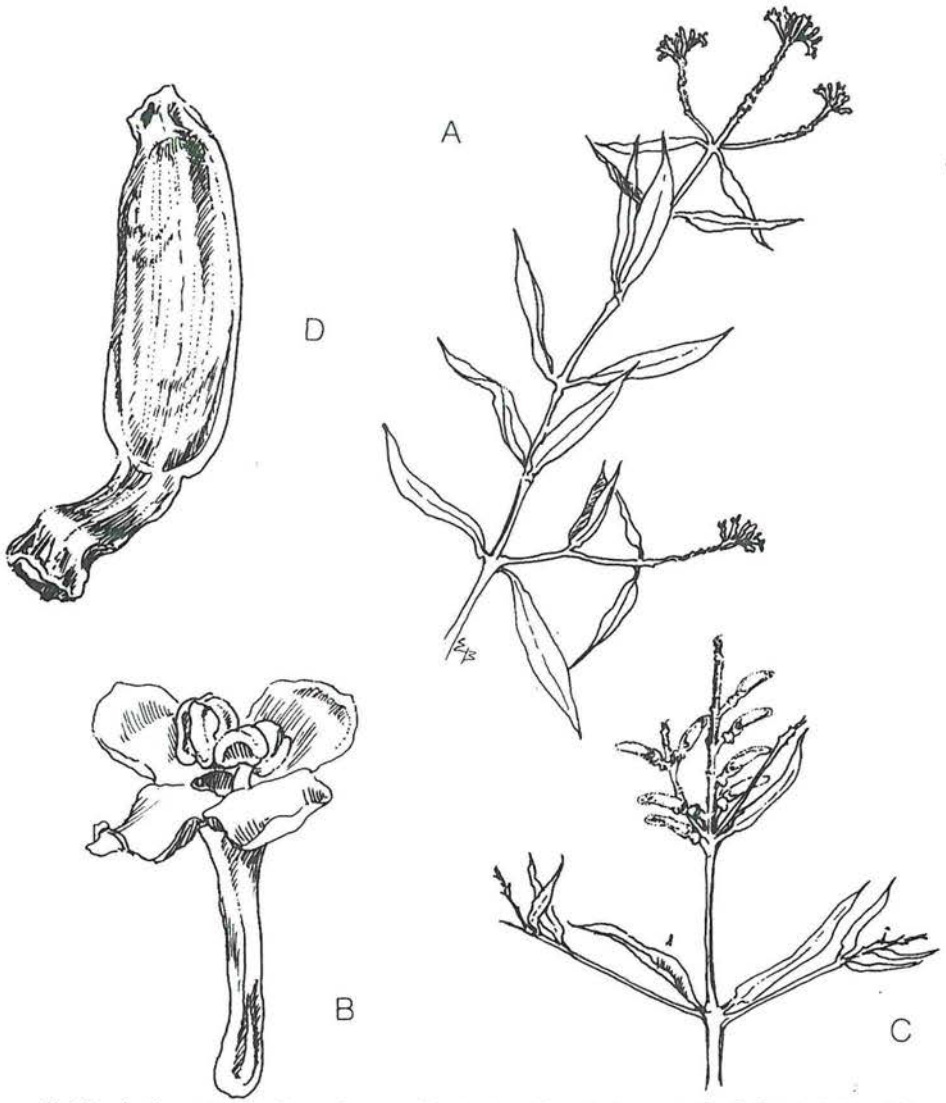

Figure 11. *Pimelea forrestiana.* A- flowering stem of male plant; B- male flower (x 10); C- female fruiting inflorescence; D- enclosed fruit and stipe (x 9). Drawn from *M.E. Trudgen* 2225 (A, B) and *N.H. Speck* 874 (C, D).

Specimens examined. WESTERN AUSTRALIA (selected from c. 30 seen): near Sandford River, Murgoo, *A.M. Ashby* 3291 (AD); between Mount Magnet and Cue, *W.E. Blackall* 79 (PERTH); West Angelas, June 1984, *J.N. Dunlop* (PERTH); Mt Tallering, *J. Galbraith* 426 (MEL, PERTH); Lake Austin, *C.A. Gardner* 2254 (PERTH); near Yalgoo, *C.A. Gardner* 13341 (PERTH); 6 mi [9.5 km] E of Hillview Homestead, *N.H. Speck* 874 (AD, CANB, PERTH); 10 mi [16 km] W of Mileura, *N.H. Speck* 997 (AD, CANB, NT, PERTH); Tallering Peak, *M.E. Trudgen* 2225 (PERTH); 66 mi [105 km] N of Wubin, *E. Wittwer* (PERTH).

Distribution. (Figure 5.) Extends from near Mileura (c. 26°24' S, 117°13' E) south to near Lake Moore (c. 29°55' S, 117°00' E) and from Mt Tallering (28°06' S, 115°38' E) east to near Hillview (26°54' S, 118°42' E). The type collection is reportedly from Mt Pyrton (21°53' S, 117°20' E) and there is a recent collection from Angelas Bore (23°07' S, 118°41' E).

Habitat. Occurs on granite outcrops and rocky hillsides.

Flowering period. June-September.

Affinities. Closest to *Pimelea spiculigera.* See notes under that species.

Notes. The inflorescence of this species is of particular interest because it generally consists of three closely associated spikes rather than a solitary spike or head as in nearly all other members of the genus. The pedicels become much enlarged in fruit, tending to be narrowly obconic or conic.

There is some doubt that the type locality and collector cited above are correct. John Forrest probably did not collect specimens in the Hamersley Range, although he did undertake an expedition through the known range of the species in 1869, accompanied by Malcolm Hamersley (Feeken et al. 1970). Perhaps the latter person's name has been confused with the range of hills.

Sect. 3. **Epallage**

Pimelea sect. *Epallage* (Endl.) Benth., Fl. Austral. 6: 5 (1873). — *Pimelea* f. *Epallage* Endl., Gen. Pl. 331 (1837). — *Calyptrostegia* III. *Epallage* (Endl.) C. Meyer, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 74 (1845). — *Banksia* sect. *Epallage* (Endl.) Kuntze in T. Post & Kuntze, Lex. Gen. Phan. 60 (1903). *Type: P. curviflora* R. Br. (lecto, fide S. Threlfall, Brunonia 5: 170 (1983)).

Pimelea e. *Malistachys* Endl., Gen. Pl. 331 (1837). — *Calyptrostegia* II. *Malistachys* (Endl.) C. Meyer, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 74 (1845). — *Pimelea* sect. *Malistachys* (Endl.) Benth., Fl. Austral. 6: 4 (1873). — *Banksia* sect. *Malistachys* (Endl.) Kuntze in T. Post & Kuntze, Lex. Gen. Phan. 60 (1903). *Type: P. argentea* R. Br.

Pimelea sect. *Eupimelea* 4. *Dasyphyllae* Meissner in DC., Prodr. 14: 509 (1857). *Type: P. nivea* Labill. (lecto here designated).

Prostrate to *large shrubs* or rarely *herbs,* usually hermaphrodite or gynodioecious, rarely dioecious or (not in Western Australia) monoecious. *Stems* hairy at least when young or rarely (not in Western Australia) glabrous; nodes abaxially prominent in shrub species but not always in herbaceous species, usually twice as thick as petiole or base of lamina. *Leaves* often concolorous, somewhat to very hairy, at least when young, or very rarely (not in Western Australia) glabrous. Sessile *involucral bracts* absent. *Inflorescence* a terminal head or of axillary clusters, each cluster terminating a very short axillary branchlet; head or clusters erect, compact

at first, sometimes becoming elongate and then commonly discontinuous, 2-many-flowered; rachis usually not enlarged laterally more than the peduncle or upper part of stem. *Pedicels* hairy. *Flowers* almost always hairy outside, glabrous inside or sometimes (not in Western Australia) hairy inside the distal part of floral tube. *Floral tube* circumscissile above ovary; ovary-portion longer or (not in Western Australia) shorter than style-portion. *Sepals* sometimes erect and apparently connate in a definite basal tube (and then the whole structure referred to as the limb), sometimes spreading and apparently free. *Stamens* 2, sometimes subsessile in throat of floral tube; connective often broad but laterally exceeded by the cells; slits adaxial to semi-lateral or rarely lateral after dehiscence. *Ovary* hairy at apex or very rarely glabrous. *Fruit* dry, enclosed in the persistent enlarged base of the floral tube.

A section of 19 species, represented in all Australian states.

Notes. The three infrageneric groups *Epallage, Choristachys* and *Malistachys* were all named in the same publication. Several species were listed for *Epallage* but only *P. spicata* and *P. argentea* were listed for *Choristachys* and *Malistachys* respectively. These two species are both readily distinguished from other species of *Pimelea* but are not considered here to be sufficiently distinctive to warrant their separation into individual sections. The former is now included within sect. *Pimelea* and the latter within sect. *Epallage.* Bentham (1873) added to *Malistachys* the rather distantly related species, *P. clavata,* which is here included in sect. *Pimelea.* Bentham and other authors added a number of extra species to *Epallage,* most of which are included here. Bentham (1873) and Threlfall (1983) used anther type as the main criterion for distinguishing sect. *Epallage,* attempting to include within the section all species with a broad connective and adaxial slits and exclude species with a narrow connective and lateral or semi-lateral slits. This resulted in a very artificial group including species which, apart from their anther type, were typical of two other sections, *Calyptrostegia* and *Heterolaena.* The criterion was also unsatisfactory because quite a few taxa, such as *P. brevifolia,* are variable in anther type, some specimens having semi-lateral slits and others adaxial slits.

A unique but not universal characteristic in this section is the occurrence of erect sepals, which are distinctly connate at the base. There are never any sessile involucral bracts and the rachis is not distinctly enlarged in comparison with the peduncle. The latter two characteristics are not found in any other section except very rarely in sect. *Pimelea.*

8. **Pimelea trichostachya** Lindley in Mitchell, J. Exped. Trop. Austral. 355 (1848). — *Calyptrostegia trichostachya* (Lindley) Walp., Annales Botanices Systematicae 3: 325 (1852). — *Banksia trichostachya* (Lindley) Kuntze, Revis. Gen. Pl. 583 (1891). *Type:* "Subtropical New Holland" [Northern Australia], 18 Oct. 1846, *T.L. Mitchell* (holo: CGE).

Annual semi-woody herb, erect, 0.15-0.5 m high, single-stemmed and deep purplish brown at ground level, hermaphrodite. *Young stems* pale green to pale yellow-brown, with scattered hairs at first but no axillary hairs, soon becoming glabrous; hairs 1-1.5 mm long. *Leaves* alternate or rarely subopposite; petiole 0.3-1.2 mm long; lamina concolorous, pale green, narrowly elliptic or linear, 2.5-16 x 0.5-3.5 mm, acute or obtuse, with scattered hairs at first, soon becoming glabrous; hairs often confined to margin, especially near apex, 0.5-1 mm long. *Inflorescence* terminal, compact and closely subtended by leaves at first, becoming elongate and interrupted at maturity, up to 90 mm long; rachis more densely hairy than young stems, the hairs similar to those on stems. *Pedicels* 0.5-1.2 mm long; hairs 0.5-0.8 mm long. *Flowers* usually green to greenish yellow, rarely white to red; tube 3.5-5 mm long, circumscissile usually 0.5-0.75 mm above ovary-portion. *Ovary-portion of floral tube* 2-3 x c. 1 mm, with a very dense mixture of long and much shorter hairs; long hairs antrorse at first, becoming patent, 2.5-3 mm long; small hairs also becoming patent, usually 0.2-0.25 mm long. *Style-portion*

of floral tube c. 1.7 mm long; proximal portion (below insertion level of stamens) with antrorse hairs similar to but often shorter than the long hairs of ovary-portion but without short hairs; distal portion 0.6-0.8 mm long, 0.4-0.7 mm diam. at summit, with appressed hairs, the longest hairs 1-1.5 mm long. *Sepals* (or free lobes) erect, broadly ovate, 0.4-0.5 mm long. *Stamens* included; filament 0.2-0.4 mm long; anther 0.4-0.5 x 0.2-0.3 mm; slits semi-lateral after dehiscence. *Ovary* 1.2-2 mm long, with apical hairs, the longest hairs 0.5-1 mm long. *Style* included. *Seeds* 2.5-3.5 x c. 1 mm, with longitudinal rows of pits.

Specimens examined. WESTERN AUSTRALIA (selected from c. 40 seen): 11 mi [17.5 km] S of Cue, *R. Aitken & D. Hutchinson* HA98 (PERTH); 73 mi [118 km] E of Norseman, 5 Sept. 1962, *T.E.H. Aplin* (PERTH); Lawler, July 1899, *W.V. Fitzgerald* (NSW); 40 km E of Sandstone, 26 Oct. 1963, *C.A. Gardner* (PERTH); near Cundeelee Mission, *A.S. George* 5898 (PERTH); 21 mi [34 km] NE of Laverton, *A.S. George* 8094 (PERTH); c. 120 mi [203 km] W of Giles Weather Station, *A.S. George* 8220 (PERTH); Barrow Range, 21 Aug. 1891, *R. Helms* (AD, MEL, NSW); New Springs Station, *R.D. Royce* 2002 (PERTH); Comet Vale, *R.D. Royce* 4404 (PERTH); 15 mi [24 km] S of Meekatharra on Nannine road, *N.H. Speck* 1029 (CANB, PERTH); 78 mi [125 km] S of Giles Meteorological Station, *D.E. Symon* 2187 (AD, ADW); Panton Creek, 144 mi [230.5 km] E of Kalgoorlie, *M.E. Trudgen* 5729 (PERTH); Eyre Hwy, c. 23 mi [37 km] E of Fraser Range, 6 Sept. 1963, *J.H. Willis* (MEL).

NORTHERN TERRITORY (selected from over 70 seen): 8.5 mi [14 km] S of Deep Well Station, *M. Lazarides* 5752 (AD, BRI, CANB, MEL, NSW, NT, PERTH); Mt Olga, *D. Verdon* 4787 (CBG).

SOUTH AUSTRALIA (selected from c. 70 seen): Maralinga, *F.L. Hill* 805 (CANB); 13 mi [21 km] NE of Loxton, *D.E. Symon* 2049 (ADW, PERTH).

QUEENSLAND (selected from over 60 seen): 43 mi [69 km] NE of Camooweal, *P. Ollerenshaw* 1309 (BRI, CANB, NT); c. 29 km E of Moonie Hwy on Colemans Rd, *K. Wilson* 1392 (BRI, NSW).

NEW SOUTH WALES (selected from c. 50 seen): Yathong Nature Reserve, *E.M. Canning* 3675 (CBG); Remington, *D.J. MacGillivray* 2829 (BRI).

VICTORIA (selected from over 15 seen): Ouyen, Dec. 1916, *N.B. Williamson* (MEL).

Distribution. (Figures 13, 14.) In Western Australia extends from near Cue (c. 27°31' S, 117°55' E) north-east to New Springs Station (c. 25°50' S, 120°00' E) and across to the Northern Territory border, and south-east to the Fraser Range (c. 31°57' S, 122°53' E) and across to the South Australian border. Also occurs in Northern Territory, South Australia, Queensland, New South Wales and Victoria.

Habitat. Recorded on sand dunes and other sandy areas, the sand often red. Also recorded in watercourses and on rocky slopes.

Flowering period. June-October.

Affinities. Closest to *Pimelea elongata,* which occurs in South Australia, Queensland and New South Wales.

9. **Pimelea argentea** R. Br., Prodr. 362 (1810). — *Calyptrostegia argentea* (R. Br.) C. Meyer, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 74 (1845). — *Banksia argentea* (R. Br.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* Bay 2 [Goose Island Bay, Middle Island], Western Australia, 15 Jan. 1802, *R. Brown* (lecto here designated: BM, female; syn: BM, male).

Pimelea myriantha Meissner in Lehm., Pl. Preiss. 1: 607 (1845). — *Calyptrostegia myriantha* (Meissner) Endl., Gen. Pl. Suppl. 4: 61 (1848). *Type:* Mt Brown and near "Beljarup" (Balgarup, S of Kojonup), Western Australia, 4 Sept. 1839, *L. Preiss* 1264 (presumed holo: LD; iso: MEL).

Pimelea shuttleworthiana Meissner in DC., Prodr. 14: 513 (1857). *Type:* south-western Australia, date unknown, *J. Drummond* 731 (lecto here designated: NY; isolecto: MEL); south-western Australia, date unknown, *J. Drummond* 730 (isosyn: MEL, NY).

Pimelea vestita Meissner in DC., Prodr. 14: 513 (1857). *Type:* Mt Matilda, York, Western Australia, 11 Sept. 1839, *L. Preiss* 1265 (lecto here designated: LD; isolecto: MEL, NY).

Pimelea argentea var. *racemosa* F. Muell., Fragm. 7: 7 (1869). *Type:* "Lake Leven" [locality unknown], Western Australia, date unknown, *G. Maxwell* (holo: MEL).

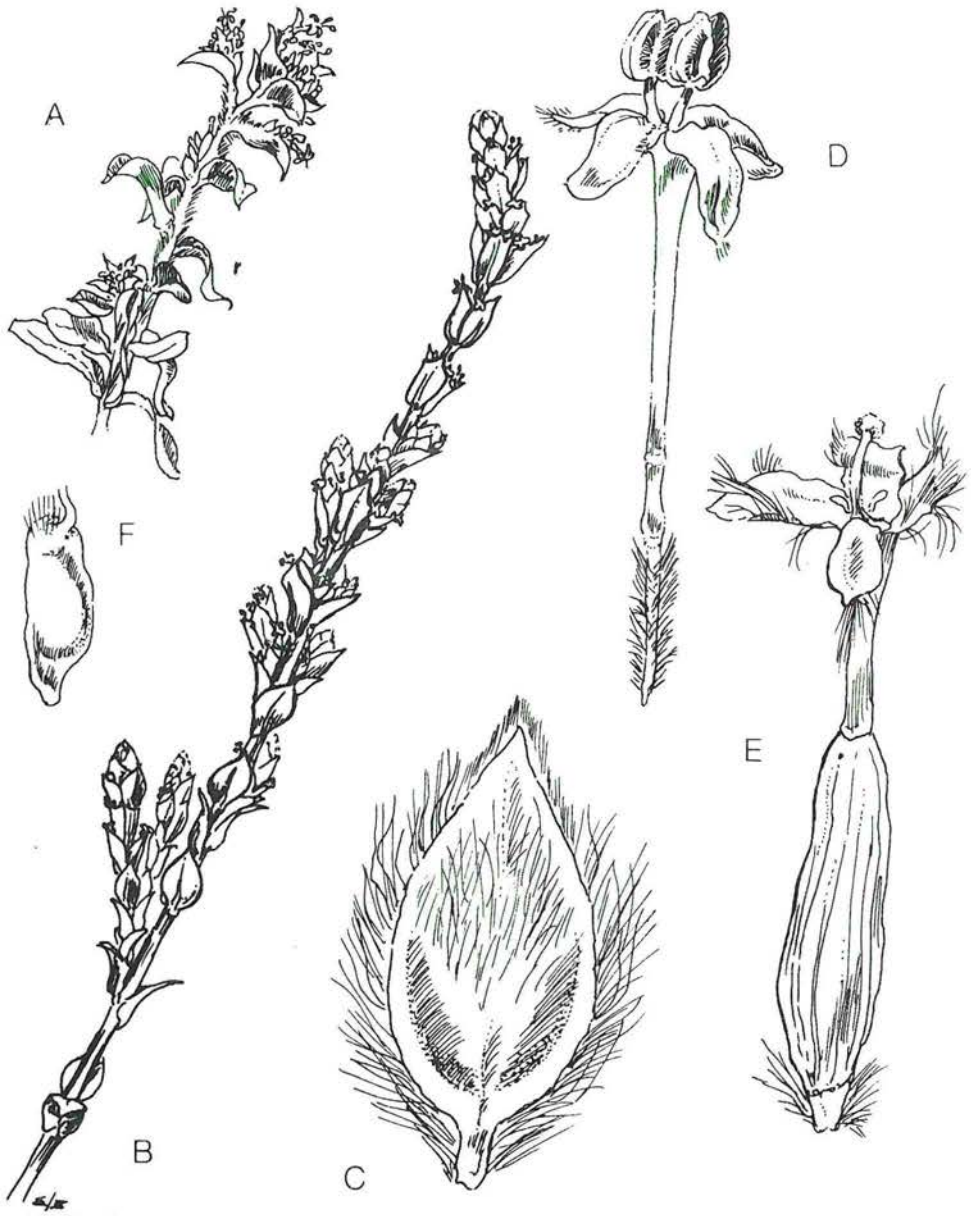

Figure 12. *Pimelea argentea.* A- flowering stem of male plant; B- flowering stem of female plant; C- leaf (x 5); D- male flower and pedicel (x 10); E- female flower and pedicel (x 15); F- ovary (x 15). Drawn from fresh material represented by *B.L. Rye* 83002 (A, C, D) and *K. Newbey* (B, E, F).

Shrub, erect, 0.4-1.8 m high, single-stemmed at ground level, often silvery or bluish green. *Stems* densely whitish-hairy when young, becoming glabrous and pale brown to reddish brown or black; hairs appressed, 0.5-2 mm long, very fine. *Leaves* alternate or opposite, usually antrorse to patent, sometimes sessile, densely covered by very fine appressed hairs 0.5-2 mm long; petiole (when present) up to 1.5 mm long; lamina concolorous, usually pale green or silvery, linear to elliptic or broadest above or below the middle within the same length/width ratios, 4-47 x 2-10 mm, acute or apiculate, soft. *Inflorescence* of axillary clusters, each sessile or terminal on a very short axillary branchlet or peduncle up to 1.5 mm long, subtended (when on a branchlet) by 1 or 2 reduced leaves with a petiole up to 0.3 mm long and lamina usually 1.5-3 x 0.8-1.5 mm; clusters dense. *Male clusters* with a rachis 0.5-1(-3) mm long; pedicels 1.5-6 mm long, with hairs 0.3-1.5 mm long. *Female clusters* with a rachis c. 0.5 mm long; pedicels 0.5-1.5 mm long, with hairs usually c. 1 mm long. *Flowers* usually yellow or cream, sometimes white or greenish white to greenish yellow, glabrous inside; sepals spreading, not appearing to be connate at base. *Male flowers:* floral tube 3-5.5 mm long, sometimes slightly swollen at base around pistillode, c. 0.5 mm diam. at summit, glabrous or with hairs 0.2-0.5 mm long; sepals elliptic or narrowly elliptic, 1.5-2 mm long, with hairs 0.4-1.5 mm long. *Female flowers:* floral tube 2.5-5 mm long, with hairs 0.5-1 mm long or very rarely glabrous, the ovary-portion 2-3 x 0.7-1.3 mm and style-portion 0.5-2 x c. 0.35 mm, circumscissile 0.5-1.5 mm below the sepals, becoming glabrous below circumscission point in fruit; sepals ovate to elliptic, 1-1.5 mm long, with hairs 0.3-1 mm long. *Stamens* much shorter than to slightly exceeding sepals; filament 0.5-1.4 mm long; anther 0.6-1.2 x 0.3-0.6 mm; connective much narrower than anther; slits lateral after dehiscence. *Staminodes* of female flowers 0.2-0.3 x 0.1-0.15 mm. *Ovary* 1.5-2.5 mm long, glabrous or with a few terminal hairs c. 0.3 mm long. *Style* exserted by 1-2.5 mm; stigma brush-like. *Pistillode* absent or minute in male flowers. *Seed* 2.5-3.5 x 0.7-1.1 mm, with an irregular shallow pattern of discontinuous ridges, bumps and pits. (Figure 12.)

Specimens examined. WESTERN AUSTRALIA (selected from over 150 seen): Qualup, *T.E.H. Aplin* 2763 (AD, PERTH); Bindoon Hill, *A.M. Ashby* 449 (AD); Dumbleyung, *A.M. Ashby* 1933 (PERTH); W of Rocky Gully, *A.M. Ashby* 3072 (AD, PERTH); Wadderin, *E.T. Bailey* 348 (PERTH); Murchison River 25 mi [40 km] above mouth, *J.S. Beard* 2066 (PERTH); Pingrup, *W.E. Blackall* 3105 (PERTH); Wagin, *S.T. Blake* 20795 (BRI); E of Walkaway, *A.C. Burns* 51 (PERTH); Mt Ney, *M.A. Clements* 1822 (CBG); near Lake Kondinin, *R.J. Chinnock* 3270 (AD); Busselton, 6 Sept. 1966, *H. Doing* (CANB, NSW); 4 km S of Wagin, *H. Eichler* 15864 (AD); 25 mi [40 km] E of Gnowangerup, *A.R. Fairall* 530 (PERTH); 16 mi [26 km] along Wanneroo Rd, *A.R. Fairall* 2230 (CANB, NSW); Susetta River, *A.S. George* 10008 (PERTH); 1 km E of Mt Lesueur, *E.A. Griffin* 2137 (PERTH); Tutanning Reserve, *J. Kelsall* 63 (PERTH); c. 16 mi [26 km] N of Geraldton, *N. McFarland* 1503 (PERTH); Darlington, 25 Aug. 1909, *A. Morrison* (BRI, CANB, NSW); Dandaragan, *R.D. Royce* 5121 (PERTH); Mt Camphorne, *R.D. Royce* 7857 (PERTH); Helena Valley, *J. Seabrook* 116 (PERTH); Middle Island, *A.S. Weston* 8807 & *M.E. Trudgen* (CANB, NSW, PERTH); Cranbrook, *C.T. White* 5440 (BRI); Boxer Island, 8 Nov. 1950, *J.H. Willis* (MEL); The Humps, *J.W. Wrigley* 5777 (CBG).

Distribution. (Figure 13.) Extends around the coast from the Murchison River (c. 27°35' S, 114°25' E) to Israelite Bay (33°37' S, 123°52' E) and inland to near Hyden (32°19' S, 118°57' E).

Habitat. Occupies varied habitats, mostly in sand or sandy clay. Occurs on coastal sand dunes and rocky areas, especially with granite, along the coast. On the Darling Range it is often associated with granite. It is also recorded growing along watercourses and around permanent or ephemeral lakes.

Flowering period. Mainly July-November.

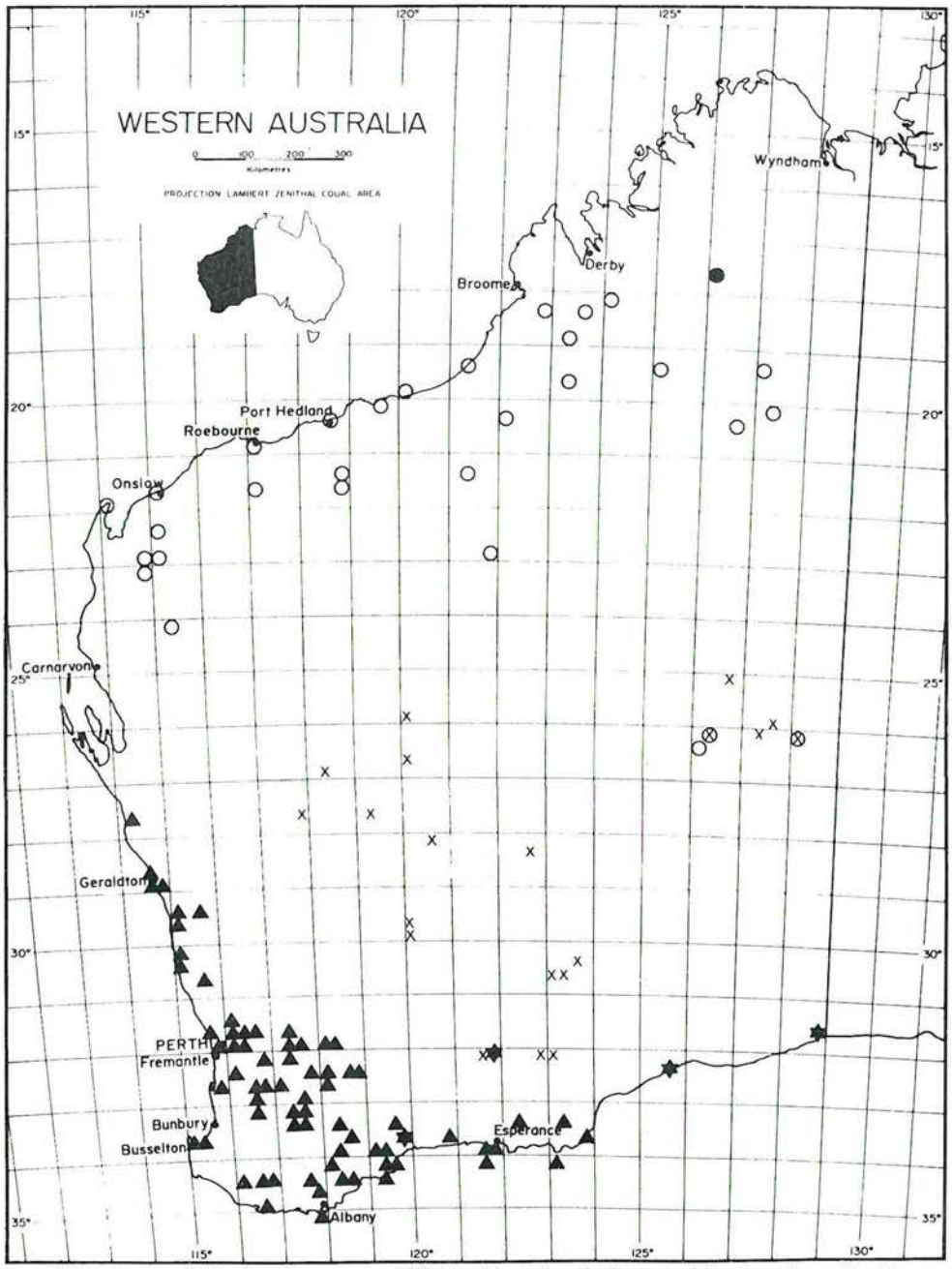

Figure 13. Distribution of *Pimelea argentea* ▲ and Western Australian distribution of *P. micrantha* ★, *P. trichostachya* x, typical variant of *P. ammocharis* ○ and Mt Leake variant of *P. ammocharis* ●.

Affinities. No close relatives but greatest affinity is with *P. micrantha.*

Notes. A very variable species. Specimens from the more humid areas, including the Darling Range, are much more lush than specimens from the drier areas. Although female flowers of *P. argentea* usually have a well developed style-portion to the floral tube, some specimens in the central and eastern part of the south coast have the style-portion very reduced.

10. **Pimelea micrantha** F. Muell. ex Meissner, Linnaea 26: 351 (1854). — *Pimelea curviflora* var. *micrantha* (F. Muell. ex Meissner) Benth., Fl. Austral. 6: 32 (1873). — *Pimelea curviflora* subsp. *micrantha* (F. Muell. ex Meissner) Threlfall, Brunonia 5: 184 (1983). *Type:* near Enfield, South Australia, Jan. 1852, *F. Mueller* (syn: NY, n.v., fide S. Threlfall, Brunonia 5: 184 (1983)).

Undershrub, erect, 80-140 mm high, single-stemmed at ground level but many-branched shortly above the ground, hermaphrodite, silvery pale green. *Stems* densely white-hairy when young, becoming glabrous and grey-brown; hairs 0.5-1.5 mm long. *Leaves* alternate to opposite, densely hairy; petiole up to 0.5 mm long; lamina concolorous, pale grey-green, narrowly elliptic to elliptic or nearly so, 3-9 x 1-3 mm; hairs appressed, white, 0.5-1.5 mm long, fine. *Inflorescence* of one or more head-like clusters, which are terminal on very short axillary branchlets, a terminal cluster often being well exceeded by 2 long lateral branchlets arising in the axils of leaves subtending the cluster, with each branchlet terminating in a younger flower cluster; clusters compact, closely subtended by leaves, few-many-flowered. *Pedicels* up to 0.5 mm long; hairs 0.5-1 mm long. *Flowers* with an orange-brown or sometimes reddish limb, white or pale-coloured below; tube 2.5-3 mm long, circumscissile usually 0.25-0.5 mm above ovary-portion, uniformly hairy, the hairs appressed and up to 0.5 mm long. *Ovary-portion of floral tube* 1.5-2 x 0.5-0.7 mm. *Style-portion of floral tube* (including proximal part of limb) c. 1 mm long, c. 0.5 mm diam. at summit. *Sepals* (or free lobes) erect, ovate, c. 0.5 mm long. *Stamens* included; filament < 0.1 mm long; anther 0.3-0.5 x 0.2-0.25 mm; slits semi-lateral after dehiscence. *Ovary* 1.5-2 mm long, with few to many hairs in an apical tuft; hairs up to 0.5 mm long. *Style* included. *Seed* 2-2.5 x 0.7-1 mm.

Specimens examined. WESTERN AUSTRALIA: Eucla, 1890, *Batt* (MEL); 21.7 km NE of Caiguna, 27 Aug. 1983, *M.J. Fitzgerald* (PERTH); 11.2 km SSW of Cocanarup Pool, Phillips River, *K. Newbey* 11355 (PERTH); c. 8 km NE of Caiguna, 27 Aug. 1983, *M.J. Fitzgerald* (AD); c. 8 km NE of Norseman, *D.J.E. Whibley* 4571 (AD).

SOUTH AUSTRALIA (selected from over 20 seen): Mambray Creek, *N.N. Donner* 4939 (AD).

NEW SOUTH WALES (selected from c. 10 seen): Wanganella, Dec. 1918, *E. Officer* (NSW).

VICTORIA (selected from 5 seen): NE edge of Lake Kenyon, *J.H. Brown* 179 (MEL).

Distribution. (Figure 13, 15.) Recorded in Western Australia from Phillips River (33°44' S, 119°52' E), near Norseman (32°12' S, 121°46' E), south of Caiguna (c. 32°16' S, 125°29' E) and Eucla (31°43' S, 128°54' E). Also recorded in South Australia, New South Wales and Victoria.

Habitat. Recorded in clay or clayey soils.

Flowering period. August-November.

Notes. This taxon belongs to a taxonomically difficult complex of *Pimeleas.* Threlfall (1983) treated the taxa of the complex as the single, extremely variable species, *Pimelea curviflora,* with three subspecies and five varieties. *Pimelea micrantha* is treated here as a species rather than as a subspecies of *P. curviflora* because it differs in having a shorter floral tube scarcely extended above the ovary, erect sepals (or free lobes) rather than spreading ones and a pear-shaped fruit rather than one that becomes uniformly narrower towards one end. It also tends to have smaller leaves and to be more hairy and silvery. However, I have seen only a selection of the material of the two species from other states and the group is greatly in need of further study throughout its range.

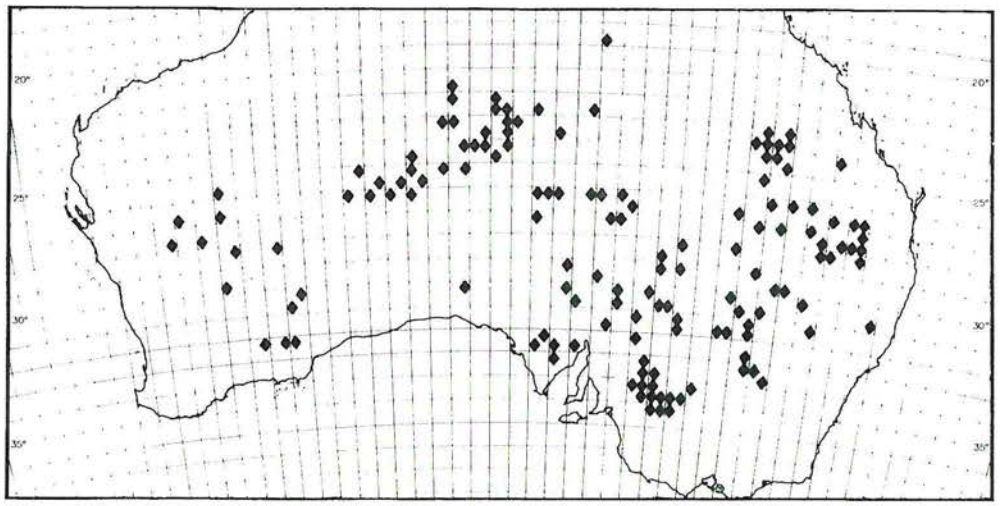

Figure 14. Distribution of *Pimelea trichostachya.*

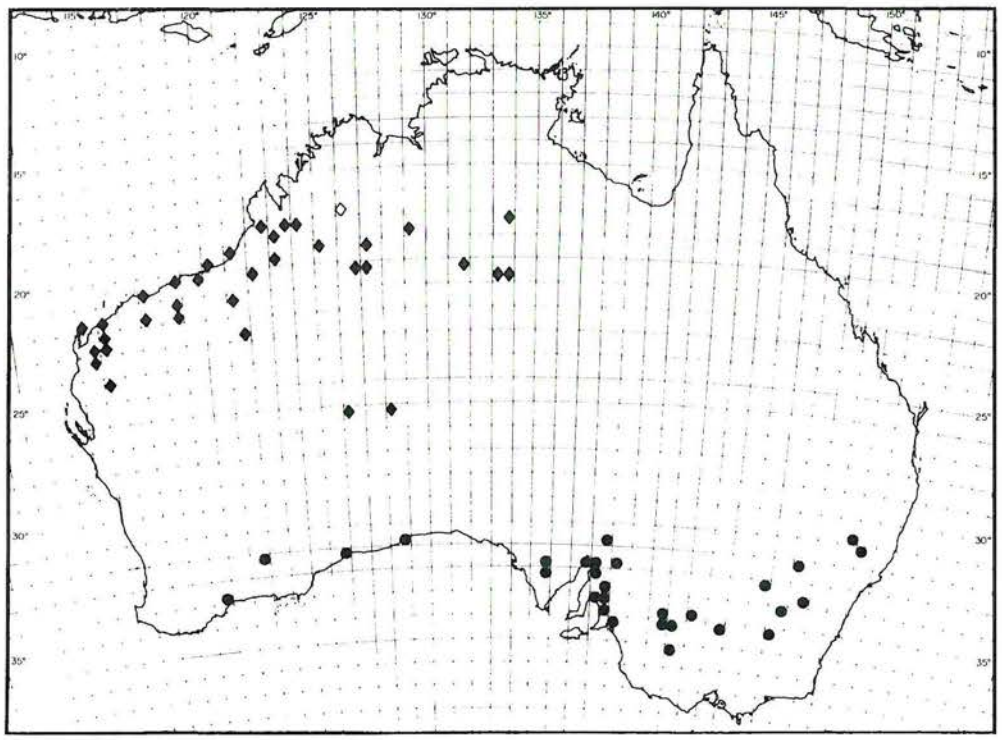

Figure 15. Distribution of *Pimelea micrantha* ●, typical variant of *P. ammocharis* ◆ and Mt Leake variant of *P. ammocharis* ◇

Sect. 4. **Calyptrostegia**

Pimelea sect. *Calyptrostegia* (C. Meyer) Benth., Fl. Austral. 6: 11 (1873). — *Calyptrostegia* C. Meyer, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 72 (1845). — *Calyptrostegia* I. *Calyptridium* C. Meyer, nom illegit., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 72 (1845). — *Calyptrostegia* A. *Calyptridium* Endl., nom. illegit. b. *Hololaena* Endl., nom. illegit., Gen. Pl. Suppl. 4: 61 (1848). — *Pimelea* sect. *Calyptrostegia* subsect. *Calyptridium* Benth., nom. illegit., loc. cit. — *Banksia* sect. *Typobanksia* Kuntze, nom. illegit. a. *Calyptridium* Kuntze, nom. illegit. in T. Post & Kuntze, Lex. Gen. Phan. 59 (1903). *Type: C. hypericina* (Cunn. ex Hook.) C. Meyer (= *P. ligustrina* Labill. subsp. *hypericina* (Cunn. ex Hook.) Threlfall).

Pimelea c. *Phyllolaena* Endl., Gen. Pl. 331 (1837). — *Pimelea* sect. *Calyptrostegia* subsect. *Phyllolaena* (Endl.) Benth., Fl. Austral. 6: 20 (1873). — *Banksia* sect. *Typobanksia* b. *Phyllolaena* (Endl.) Kuntze (as *Phylloclaena*) in T. Post & Kuntze, Lex. Gen. Phan. 59 (1903). *Type: P. imbricata* R. Br. (lecto here designated).

Pimelea sect. *Eupimelea* 3. *Imbricatae* Meissner in DC., Prodr. 14: 506 (1857). *Type: P. ammocharis* F. Muell. (lecto here designated).

Shrubs or *undershrubs,* usually hermaphrodite or gynodioecious, rarely dioecious. *Stems* with inconspicuous hairs in the upper axils or with more widespread hairs; nodes abaxially prominent, c. twice as thick as petiole or base of lamina. *Leaves* opposite or rarely alternate, glabrous or sometimes hairy. Sessile *involucral bracts* (2)4-numerous, usually well differentiated from leaves, sometimes either strongly recurved at apex or becoming reflexed in fruit. *Inflorescence* terminal, head-like, rarely somewhat elongate at maturity but always continuous, with (2-)4-numerous flowers (many-flowered in Western Australian species); receptacle well developed, more or less flat or convex. *Pedicels* with dense antrorse to appressed hairs or very rarely (not in Western Australia) glabrous. *Floral tube* circumscissile above ovary or very rarely persistent intact in fruit; style-portion longer than ovary-portion in flower and usually in fruit. *Sepals* spreading. *Stamens* 2, lateral to strictly adaxial, usually semi-lateral after dehiscence. *Ovary* often with an apical tuft of hairs, sometimes hairy throughout or glabrous. *Fruit* dry, enclosed in the persistent enlarged base of floral tube.

A section of 33 species, occurring in all Australian states, mainly in temperate areas.

Notes. This diverse section has close links with sections *Pimelea, Epallage, Heterolaena* and *Macrostegia* as discussed under those sections. Sect. *Calyptrostegia* is characterised mainly by the compact or slightly elongate, but always continuous, inflorescence with sessile involucral bracts and by the usually elongate and regularly circumscissile floral tube.

11. **Pimelea ammocharis** F. Muell., Hooker's J. Bot. Kew Gard. Misc. 9: 24 (1857). — *Banksia ammocharis* (F. Muell.) Kuntze., Revis. Gen. Pl. 2: 583 (1891). *Type:* Sturt Creek, Western Australia, Feb./Mar. 1856, *F. Mueller* (holo: MEL).

Pimelea ammocharis var. *maitlandii* F. Muell., Fragm. 7: 5 (1869). *Type:* 20 mi [32 km] S of Nickol Bay, Western Australia, *M. Brown* (holo: MEL).

Undershrub or *shrub,* 0.2-1.8 m high, probably single-stemmed at ground level, dioecious or (in variant from Mt Leake) hermaphrodite. *Young stems* greyish, densely covered by a mixture of appressed to patent hairs 1-2 mm long and much shorter hairs, becoming glabrous and dark reddish brown or grey-brown. *Leaves* alternate, antrorse to patent, densely hairy; petiole 0.2-1 mm long; lamina concolorous, silvery pale green, usually narrowly elliptic, 4-17

x 1-5 mm, acute or subacute; hairs appressed on both surfaces but spreading laterally from lamina, 1-2 mm long. *Involucral bracts* 6-12 immediately surrounding inflorescence, intergrading below with the leaves, the same colour as leaves or more brownish, 7-14 x 1.5-4 mm, more densely hairy than leaves; hairs oriented as on leaves, 1-2 mm long in bisexual plants, 2-3 mm long in male plants and 3-4 mm long in female plants. *Inflorescence* terminal, head-like, erect or pendulous; rachis compact or (in variant from Mt Leake) elongate and up to 9 mm long. *Pedicels* up to 0.5 mm long; hairs up to 3 mm long. *Flowers* usually pale to deep yellow, rarely white or a combination of white and yellow, densely hairy outside, the indumentum a mixture of hairs of greatly varying length, glabrous inside except for the ovary. *Floral tube of male flowers* narrowly cylindric, 5.5-11 x 0.6-1 mm, almost uniformly hairy throughout or with longer hairs in proximal half; longest hairs of proximal half antrorse or sometimes patent, 2-4(-6) mm long; longest hairs of distal portion usually patent, 1-1.5 mm long. *Floral tube of female or bisexual flowers* narrowly cylindric with only a slight enlargement around ovary, 6-11 x c. 1 mm, not circumscissile but sometimes breaking irregularly above the mature fruit, with much longer hairs in proximal half; hairs antrorse to patent, the longest hairs 7-9 mm long in proximal portion and 1-3 mm long in distal portion. *Sepals* elliptic or broadly elliptic, 1.5-4 mm long, tending to be larger in male than in female flowers, densely hairy outside. *Stamens:* filament up to 0.2 mm long; anther 0.8-1.4 x 0.4-1 mm; connective very broad but slightly narrower than anther; slits adaxial. *Staminodes* of female flowers: anther 0.5-0.7 x 0.2-0.3 mm. *Ovary* with subterminal and terminal hairs 1.75-2.5 mm long. *Stigma* scarcely exserted or exserted by up to 3 mm. *Pistillode* of male flowers included, with hairs 1-2.5 mm long on abortive ovary. *Seed* c. 6 x 2 mm, with a prominent pattern of irregular bumps and hollows, which are more or less alligned horizontally into wavy ridges and furrows respectively.

Specimens examined. WESTERN AUSTRALIA (selected from over 70 seen): Mt Bannerman, *J.S. Beard* 5612 (PERTH); Millstream, *M.I.H. Brooker* 2088 (AD, PERTH); Anna Plains Station, *N.T. Burbidge* 1398 (PERTH); Woodstock Station, *N.T. Burbidge* 5975 (CANB); Blackstone Range, *R.C. Carolin* 6037 (NSW); Williambury Station, Kennedy Range, *R.J. Cranfield* 1905 (PERTH); Vlaming Head, *H. Demarz* 6110 (PERTH); Mt Leake, *W.V. Fitzgerald* 1200 (NSW, PERTH); Millstream, *C.A. Gardner* 6288 (PERTH); pass in Blackstone Range, *A.S. George* 5248 (PERTH); 22 mi [35 km] W of Warburton Mission, *A.S. George.* 8377 (NT, PERTH); McLarty Hills, *A.S. George* 14720 (PERTH); Roebourne, *J.N. Hutchinson* 78 (PERTH); near Edgar Range, *K.F. Kenneally* 5561 (PERTH); 21 mi [34 km] SW of Luluigui Station, *M. Lazarides* 6538 (BRI, CANB, MEL, NSW, NT, PERTH); Anketell Ridge, *A.S. Mitchell* 1121 (NT, PERTH); Onslow, *S.P. Pfeiffer* 33 (PERTH); Abydos Station, *F. Richardson* 13 (PERTH); Rudall River area, *P.G. Wilson* 10544 (AD, NT, PERTH).

NORTHERN TERRITORY (selected from over 30 seen): Lander River, *N.M. Henry* 644 (BRI, CANB, MEL, NT, PERTH); 11 mi [17.5 km] N of Helen Springs Station, *R.A. Perry* 1905 (AD, BRI, CANB, NT, PERTH).

Distribution. (Figures 13, 15.) In Western Australia extends from Kennedy Range (24°14' S, 115°15' E) east to the border, reaching Mt Leake (17°33' S, 126°02' E) in the north and extending south to near the junction of Western Australia, Northern Territory and South Australia (26°S, 129°E).

Habitat. Mostly recorded from red sandy soils on dunes or from rocky rises in arid and semiarid regions.

Flowering period. Mainly May-October.

Affinities. Closest to *Pimelea penicillaris*, which occurs in South Australia, New South Wales, Queensland and Northern Territory.

Notes. Although there are no collections from South Australia, *Pimelea ammocharis* may well occur in the extreme north-west of that state because it has been collected close to the junction of the South Australian border with Western Australia and Northern Territory.

A variant known only from a single collection *(W.V. Fitzgerald* 1200) needs to be further collected and studied to determine whether it is best regarded as a subspecies of *P. ammocharis* or whether it is sufficiently distinct to be treated as a new species. It was collected in flower in July from the summit of Mt Leake north of the range of the type variant of *P. ammocharis* and differs mainly in being hermaphrodite rather than dioecious, in having shorter hairs on the involucral bracts and in the inflorescence tending to become elongate.

12. **Pimelea graniticola** Rye, sp. nov. (Figure 16.)

Affinis *P. imbricatae* R. Br. sed differt foliis angustioribus et bracteis involucralibus numerosioribus.

Typus: SE slope of Chiddarcooping Hill, Western Australia, 5 Nov. 1984, *A.S. Weston* 14511 (holo: PERTH; iso: CANB, K, MEL, NSW).

Related to *P. imbricata* R. Br. but differs in the narrower leaves and more numerous involucral bracts.

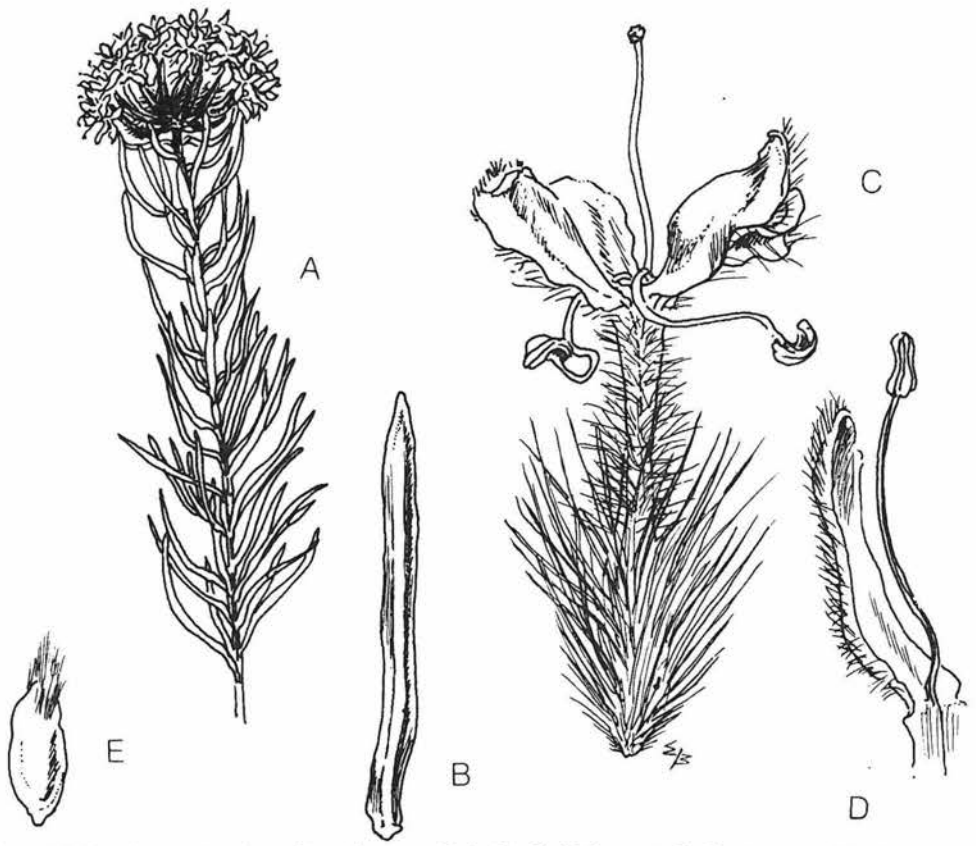

Figure 16. *Pimelea graniticola.* A- flowering stem; B- leaf (x 5); C- flower (x 9); D- stamen (x 13); E- ovary (x 13). Drawn from *K. Newbey* 6527.

Shrub, erect, spreading, 0.2-1 m high, single-stemmed at ground level. *Stems* pale yellow-green or red-brown near each inflorescence, becoming medium grey to almost black further from apex, glabrous. *Leaves* alternate, antrorse to patent, glabrous except when immediately below an inflorescence; petiole up to 0.3 mm long; lamina concolorous, pale green to bluish green, linear, 4-17 x 0.5-1 mm, flat or adaxially concave, acute or obtuse. *Peduncle* up to 1 mm long. *Involucral bracts* numerous, usually c. 40, becoming reflexed in fruit, similar in colour to leaves, narrowly triangular to linear, 6-8 x 1-2 mm, glabrous or sparsely hairy outside, densely hairy inside, ciliate; hairs appressed to antrorse, 0.3-1.5 mm long, the longest cilia 1-1.5 mm long. *Inflorescence* erect, compact. *Pedicels* 0.2-0.5 mm long; longest hairs c. 1 mm long. *Flowers* bisexual, cream or white above circumscission point; floral tube 5-7.5 mm long, circumscissile at summit of ovary-portion. *Ovary-portion of floral tube* 1.5-2.5 x c. 1 mm, very densely hairy outside and dark-coloured but the colour hidden by the hairs, glabrous inside; hairs antrorse, the longest ones 2-5 mm long, longer than and less fine than hairs above circumscission point. *Style-portion of floral tube* cylindric, 3.5-5 mm long, c. 1 mm diam. at summit, with long antrorse to patent hairs and smaller patent hairs outside, the longest ones 1-2.5 mm long and shortest ones c. 0.2 mm long, with patent to antrorse hairs 0.2-0.5 mm long occurring inside. *Sepals* elliptic or narrowly elliptic, 2-5 mm long, with hairs on outside similar to those on distal part of floral tube, the longest ones 1-2 mm long, glabrous inside. *Stamens* longer than or sometimes more or less equalling sepals; filament 2.5-3 mm long; anther 0.6-0.8 x 0.3-0.4 mm; connective broad, slightly narrower than anther; slits adaxial. *Ovary* with hairs in distal part; longest hairs 0.6-1 mm long. *Style* exserted by 3-5 mm. *Seed* not seen.

Specimens examined. WESTERN AUSTRALIA: Mt Gibbs, *J.S. Beard* 3711 (PERTH); Norseman-Mt Holland Rd, *C.A. Gardner & W.E. Blackall* 1245 (PERTH); Mt Gibbs, *F. Lullfitz* 3914 (PERTH); Mt Gibbs, *K. Newbey* 6527 (PERTH); Stennet Rock, *K. Newbey* 7677 (PERTH); 9.3 km NNW of Roes Rock, *K. Newbey* 11044 (PERTH); Mt Gibbs, Dec. 1929, *H. Steedman* (PERTH).

Distribution. (Figure 18.) Extends from Chiddarcooping Hill (30°54' S, 118°41' E) south to near Roes Rock (33°55' S, 119°20' E) and from near Pingaring (c. 32°47' S, 118°39' E) east to Stennet Rock (32°35' S, 121°33' E).

Habitat. Occurs on granite outcrops, in soil pockets or shallow soil over granite sheets.

Flowering period. September-December.

Conservation status. Pimelea graniticola has a scattered distribution on granite rocks. Only one plant was observed at Chiddarcooping Hill (A.S. Weston pers. comm.) and several other populations are also small (K. Newbey pers. comm.). The species may be rare and needs to be surveyed to assess its conservation status.

Derivation of name. Graniti (L.) — granite — *cola* (L.) — to inhabit, referring to the occurrence of the species on granite outcrops.

Affinities. Closest to *Pimelea imbricata* but perhaps more readily confused with *P. villifera*, from which it differs in having more numerous involucral bracts.

13. **Pimelea imbricata** R. Br., Prodr. 361 (1810). — *Banksia imbricata* (R. Br.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* King George Sound, Western Australia, Dec. 1801, *R. Brown* (BM).

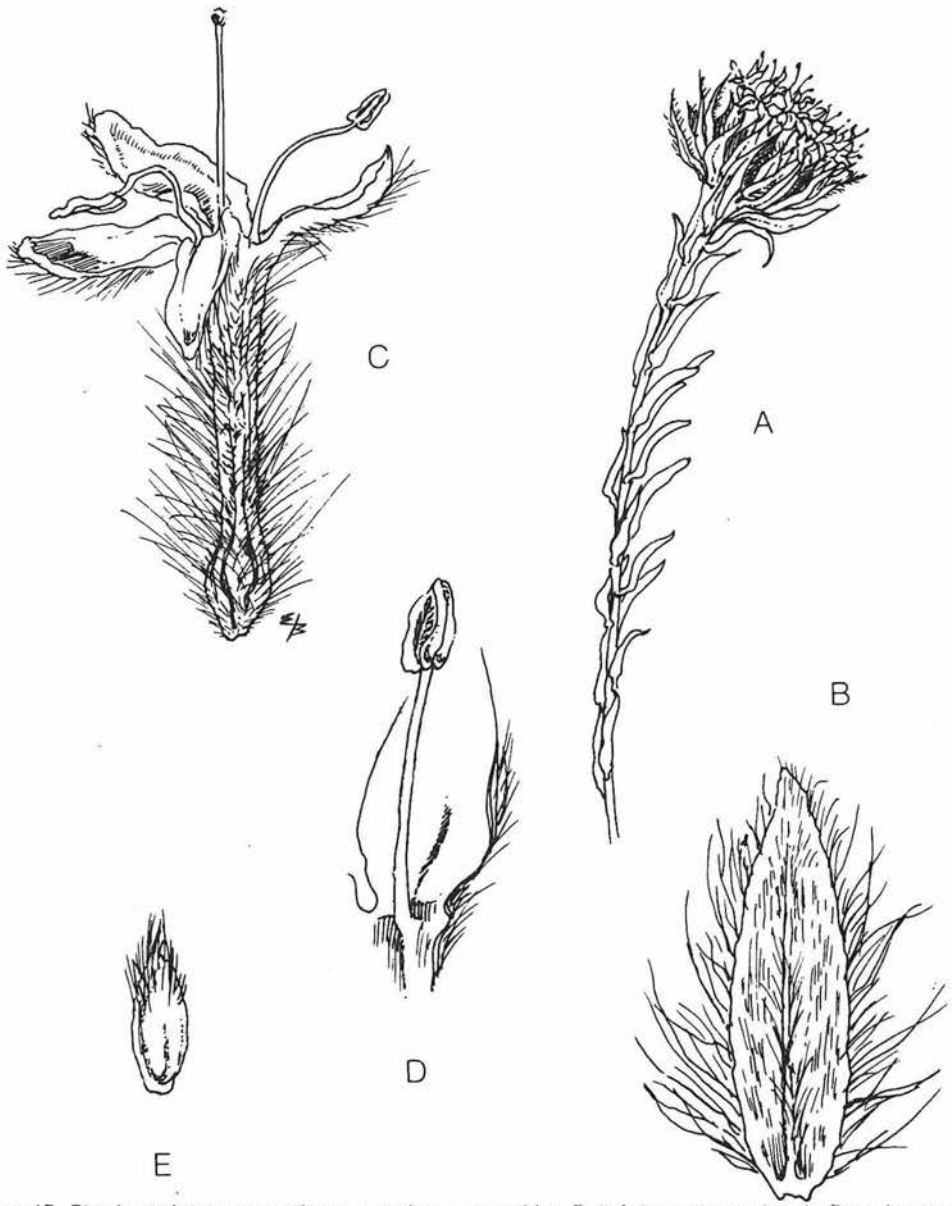

Figure 17. *Pimelea imbricata* var. *piligera*, a variant approaching *P. imbricata* var. *major*. A- flowering stem; B- bract (x 5); C- flower (x 7); D- stamen (x 12); E- ovary (x 12). Drawn from fresh material represented by *N. Cohen* 1029.

Shrub, erect, (0.1-)0.2-0.8(-1) m high, often multi-stemmed at ground level. *Stems* glabrous to densely hairy and deep red or red-brown (rarely yellow-brown first) near each inflorescence (but sometimes appearing silvery if densely hairy), becoming medium grey and glabrous further from apex; indumentum (when present) usually a mixture of patent hairs 1-2 mm long and shorter patent hairs 0.1-0.5 mm long, sometimes of long hairs alone. *Leaves* alternate or sometimes opposite, antrorse or rarely patent, more or less sessile or with a definite petiole; petiole up to 0.5 mm long; lamina concolorous, medium green to deep bluish green, linear to elliptic, usually narrowly elliptic or nearly so, 1-16 x 0.6-4(-5) mm, flat or adaxially concave, obtuse or acute, usually moderately to densely hairy on both surfaces, sometimes sparsely

hairy or glabrous, rarely prominently ciliate but with no or few hairs on the surfaces; hairs antrorse to appressed, the longest usually 1-3 mm long. *Peduncle* up to 6 mm long. *Involucral bracts* 10-20 or sometimes more, becoming reflexed in fruit, all sessile or some very shortly petiolate, similar to leaves in colour or sometimes partially (especially near apex) deep red to purple, linear to ovate, usually narrowly ovate, usually 6-12 x 1-5 mm, usually densely hairy on both surfaces, sometimes sparsely hairy or glabrous outside, rarely glabrous except near middle or base inside; hairs appressed to antrorse, spreading rather widely laterally from the margin, the longest ones on outside or margin 2-2.5 mm long. *Inflorescence* erect, compact. *Pedicels* 0.2-0.6 mm long; longest hairs 1-3(-5.5) mm long. *Flowers* bisexual or female, white to cream or sometimes pale to deep pink, with hairs usually 0.2-0.4 mm long inside style-portion of floral tube, glabrous inside sepals; tube 3.5-10 mm long, usually tardily circumscissile 0.5-1 mm above ovary-portion, sometimes apparently persistent. *Bisexual flowers*: ovary-portion of floral tube usually 2-2.5 x c. 0.7 mm, densely hairy; hairs of ovary-portion antrorse or sometimes patent, the hairs in distal part similar in length or grading into those on style-portion, the hairs below usually shorter, the longest hairs 2-3(-4) mm long, the short hairs commonly c. 0.2 mm long; style-portion of floral tube cylindric or narrowly cylindric, 4-7.5 mm long, 0.8-1.2(-1.5) mm diam. at summit, either densely covered outside by a mixture of long patent hairs up to 2.5 mm long and shorter patent hairs 0.1-0.3 mm long or moderately densely to sparsely covered by long hairs outside; sepals elliptic to ovate, 2.5-3.5 mm long, with a rather similar indumentum to that of distal part of floral tube; stamens longer or rarely shorter than sepals, the filament 1.2-3.5 mm long, the anther 0.5-1.2 x 0.2-0.4 mm, the connective narrower than anther, the slits more or less semi-lateral after dehiscence; ovary hairy at summit, the longest hairs c. 0.3 mm long; style exserted by 2.5-5 mm. *Female flowers*: ovary-portion of floral tube 1.5-2 x c. 0.7 mm, densely hairy; hairs of ovary-portion antrorse or patent, the longest hairs 0.3-2.5 mm long; style-portion of floral tube shortly cylindric or cylindric, 3.5-6(-7) mm long, c. 1 mm diam. at summit, densely covered by a mixture of antrorse to patent hairs 1.5-2.5 mm long and shorter patent hairs 0.1-0.3 mm long; sepals elliptic to ovate, 1.5-2.5 mm long, densely hairy, the indumentum similar to that on distal part of floral tube; staminodes shorter than sepals, with a filament 0.4-0.6 mm long and anther 0.2-0.5 x 0.1-0.4 mm; ovary similar to that of bisexual flowers but tending to be smaller; style exserted by 3-5(-7) mm, the stigma usually brush-like. *Seed* 2-3 x c. 1 mm, with longitudinal rows of minute pits. (Figure 17.)

Distribution. (Figures 18, 19, 20.) Widespread in south-western Australia from the Murchison River to east of Esperance and inland to Sandstone. Also occurs in South Australia.

Flowering period. August-March, especially September-January.

Affinities. Closest to *Pimelea subvillifera.*

Notes. A very variable taxon in Western Australia, with three main variants occupying distinct geographical areas. The variants could be recognised either as subspecies or varieties, perhaps with equal justification. Varietal rank has been used by all previous authors and has been retained here because there appears to be considerable intergradation between the widespread *P. imbricata* var. *piligera* and each of the other two variants in Western Australia and because differences between var. *piligera* and the South Australian variant are minimal.

More field work is needed to determine how complete an intergradation there is between Western Australian variants. Limited examination of the species on the coastal plain near Perth suggests that western populations are of typical *P. imbricata* var. *major* but that the plants become progressively hairier towards the Darling Scarp and become typical of *P. imbricata* var. *piligera* before the scarp is reached. Indeed in Western Australia as a whole, there is a tendency for plants to be relatively glabrous near the coast and progressively more hairy the further inland they occur.

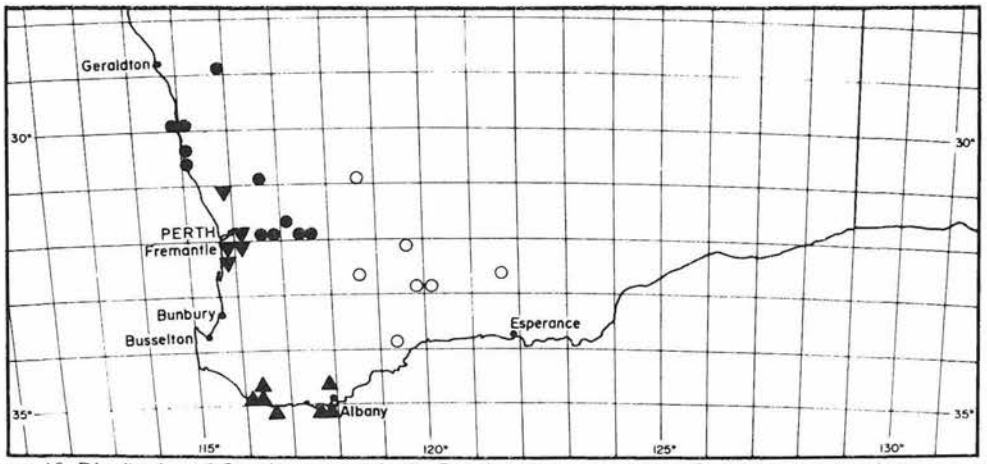

Figure 18. Distribution of *Pimelea graniticola* ○, *P. imbricata* var. *major* ▼, *P. imbricata* var. *imbricata* ▲ and *P. villifera* ●.

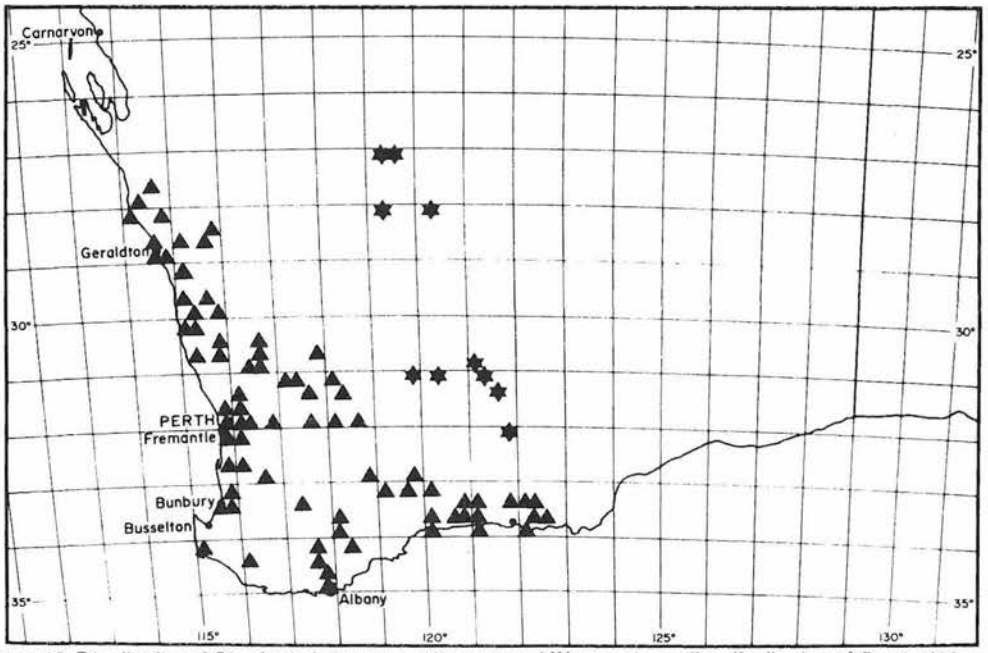

Figure 19. Distribution of *Pimelea imbricata* var. *piligera* ▲ and Western Australian distribution of *P. subvillifera* ★.

Key to Varieties

1. Style-portion of floral tube sparsely to moderately densely hairy, the hairs all long. Stems glabrous.....13a. var. *major*
1. Style-portion of floral tube densely covered by a mixture of long and short hairs. Stems nearly always hairy near each inflorescence.
   2. Flowers pale to deep pink.....13b. var. *imbricata*
   2. Flowers white or cream, very rarely pink-tinged.
      3. Floral tube of bisexual flowers 6-10 mm long, with hairs inside reaching summit or to well within 1 mm of summit. Anthers 0.6-1 mm long, if nearly as wide as long then floral tube 6-8 mm long.....13c. var. *piligera*

3. Floral tube of bisexual flowers 8-11 mm long, with hairs inside absent or nearly so from uppermost 1 mm of tube. Anthers c. 0.5 mm long, nearly as wide as long.....13d. var. *petraea*

13a. var. **major** (Meissner) Rye, comb. nov.

Pimelea microcephala var. *major* Meissner in Lehm., Pl. Preiss 1: 606 (1845). — *Pimelea imbricata* var. *glabrata* Meissner in Lehm., Pl. Preiss. 2: 270 (1848). — *Pimelea imbricata* var. *gracillima* Meissner in DC., Prodr. 14: 507 (1857). — *Pimelea imbricata* f. *gracillima* (Meissner) Benth., Fl. Austral. 6: 21 (1873). *Type*: south-western Australia, date unknown *J. Drummond* 552 (iso: MEL).

Stems glabrous, deep red-brown. *Leaves* opposite or alternate (usually some of each arrangement on each plant), medium green, linear to narrowly oblong or narrowly ovate to narrowly obovate, up to 16 mm long, glabrous. *Involucral bracts* medium green, glabrous outside (very rarely sparsely hairy), hairy inside but the hairs sometimes confined to the middle and base, sometimes ciliate, when ciliate the margin usually toothed, each tooth terminating in a cilium. *Flowers* white. *Floral tube*: ovary-portion densely hairy, the longest hairs 3-4 mm long; style-portion sparsely to moderately densely hairy, the hairs all long, the longest ones 2-2.5 mm long.

Specimens examined. WESTERN AUSTRALIA (selected from over 35 seen): Serpentine, *T.E.H. Aplin* 1230 (PERTH); Ellen Brook Sanctuary, *N.T. Burbidge* 7916 (CANB); Jandakot, *H. Demarz* 9144 (PERTH); Mahogany Creek, *Diels & Pritzel* 225 (PERTH); Kenwick, *G.J. Keighery* 4162 (PERTH); 9 mi [14.5 km] N of Gingin, *V. Mann & A.S. George* 179 (PERTH); Cannington, 14 Oct. 1911, *A. Morrison* (BRI, CANB).

Distribution. (Figure 18.) Extends from north of Gingin (31°21' S, 115°54' E) south to Serpentine (33°22' S, 115°58' E).

Habitat. Restricted to the coastal plain, occurring in sand over clay or sandy clay in low-lying areas associated with seasonally waterlogged depressions or watercourses.

Flowering period. Mainly October-January, also recorded February.

Affinities. Closest to *Pimelea imbricata* var. *piligera.* Apart from the characters given in the key, var. *major* differs from var. *piligera* in the longer hairs on the ovary-portion of the floral tube. *Pimelea imbricata* var. *major* tends to have narrower leaves than all the other varieties.

Notes. All of the specimens examined were bisexual. Specimens collected from Mahogany Creek have strongly ciliate and distinctly denticulate involucral bracts whereas in other specimens the involucral bracts are not ciliate or not prominently so and are entire. Another difference is that the hairs on the ovary-portion of Mahogany Creek specimens are very short compared with those of other specimens. The Mahogany Creek variant needs further investigation.

13b. var. **imbricata**

Pimelea imbricata var. *baxteri* Cunn. ex Meissner in DC., Prodr. 14: 507 (1857). — *Pimelea imbricata* f. *baxteri* (Cunn. ex Meissner) Benth., Fl. Austral. 6: 21 (1873). *Type*: south-western Australia, date unknown, *W. Baxter* (lecto here designated: NY; isolecto: MEL); Mt Clarence, Western Australia, 25 Nov. 1840, *L. Preiss* 1273 (syn: LD, NY).

Stems moderately densely hairy and reddish near each inflorescence. *Leaves* opposite or alternate, medium green, usually narrowly elliptic, up to 8 mm long, glabrous or the uppermost ones ciliate or rarely all sparsely to densely hairy. *Involucral bracts* often partially red to purple, entire, hairy throughout. *Flowers* pale to deep pink. *Floral tube* densely hairy outside, ovary-portion sometimes slightly more densely hairy than style-portion but the hairs not longer or scarcely longer than those of style-portion; style-portion densely covered by a mixture of long and much shorter hairs, the longest hairs 1.3-2 mm long.

Specimens examined. WESTERN AUSTRALIA (selected from over 35 seen): Mt Chudelup, *T.E.H. Aplin* 1433 (PERTH); 56 km S of Manjimup, *H. Demarz* 7792 (PERTH); Albany, Oct. 1964, *J. Galbraith* (MEL); near Boggy Lake, 6 mi [10km] SW of Walpole, *J.W. Green* 1028 (PERTH); Nancy Peak, *N.D. Lovett* 527 (PERTH); Shannon, 12 Dec. 1877, *F. Mueller* (MEL); Nillup, *R.D. Royce* 44 (PERTH); near Bornholm, *A. Strid* 21813 (PERTH); Quaranup, *J. Taylor* 1800 & *P. Otterenshaw* (CBG); road to Point Nuyts, 14 Oct. 1968, *J.W. Wrigley* (CBG).

Distribution. (Figure 18.) Extends from Mt Chudalup (34°46' S, 116°05' E) east to Albany (35°02' S, 117°53' E), with an isolated occurrence at Nillup (34°10' S, 115°16' E).

Habitat. Occurs in sand, associated with granite or with seasonally waterlogged depressions.

Flowering period. October-January, also recorded in March.

Affinities. Closest to *Pimelea imbricata* var. *piligera.*

Notes. A further syntype examined was "Toodjay" (Toodyay), Western Australia, date unknown, *J. Gilbert* (NY). This is not cited above because it is of *P. imbricata* var. *piligera.* All of the specimens of var. *imbricata* examined were bisexual.

13c. var. **piligera** (Benth.) Diels & E. Pritzel, Bot. Jahrb. Syst. 35: 397 (1904). — *Pimelea imbricata* f. *piligera* Benth., Fl. Austral. 6: 21 (1873). *Type:* south-western Australia, *J. Drummond* coll. 1, n. 553 (lecto here designated: K); Darling Range, Perth, Western Australia, 1 Nov. 1839, *L. Preiss* 1275 (isosyn: LD); "Greenmountain" [Greenmount], Western Australia, 16 Oct. 1839, *L. Preiss* 1277 (isosyn: LD); Port Gregory, Western Australia, date unknown, *A.F. Oldfield* (syn: K).

Stems usually densely hairy, rarely moderately hairy, very rarely glabrous. *Leaves* alternate, usually densely hairy and medium to dark bluish green or deep green, rarely sparsely hairy or glabrous and medium green, usually narrowly elliptic, up to 14 mm long. *Involucral bracts* the same colour or more silvery than leaves or partially deep red to purple, entire, usually densely hairy throughout. *Flowers* white to cream (rarely pink-tinged). *Floral tube*: ovary-portion with hairs up to 2.5 mm long, usually much shorter in female than in bisexual flowers; style-portion densely covered by a mixture of long and much shorter hairs, the longest hairs usually 1-2 mm long. (Figure 17.)

Specimens examined. WESTERN AUSTRALIA (selected from over 250 seen): Salt River Rd, c. 17 km E of Cranbrook, *A.M. Ashby* 5087 (AD); 6 mi [10 km] W of Agnew, *J.S. Beard* 6580 (PERTH); Lake Cowan, *N.T. Burbidge* 2733 (CANB); Moresby Range, *A. C. Burns* 2, 3 (PERTH); Lake Wagin, 1890, *M. Cronin* (MEL); c. 3 km NW of Young River crossing on Ravensthorpe-Esperance Rd, *N.N. Donner* 2769 (AD, CANB, PERTH); Waterloo, *G.J. Keighery* 6503 (PERTH); Dwellingup, *P.C. Kimber* 187 (PERTH); Cowcowing, *M. Koch* 1245 (MEL, PERTH); Wooroloo, *M. Koch* 1754 (AD, MEL, PERTH); Pindar, Oct. 1909, *J.H. Maiden* (NSW); Forrestdale, *V. Mann & A.S. George* 13 (PERTH); Mt Bakewell, Nov.

1877, *F. Mueller* (MEL); Mt Gibbs, *K. Newbey* 6526 (PERTH); c. 21 km NNW of coast at Stokes Inlet, *A.E. Orchard* 1674 (AD, CANB, PERTH); Murchison River gorge, 27 Sept. 1962, *M.E. Phillips* (CBG); Cockleshell Gully, 24 Sept. 1968, *M.E. Phillips* (CGB, MEL); Pinjarrah, Oct. 1872, *J.S. Price* (MEL); Watheroo National Park, *R.D. Royce* 9544 (PERTH); Mt Burdett, *B.L. Rye* 82020 (PERTH); Mt Caroline, 1886, *G.A. Sewell* (MEL); c. 35 km N of Merredin *D.J.E. Whibley* 4716 (AD, PERTH); Wickepin-Harrismith, *E. Wittwer* 887 (PERTH).

Distribution. (Figure 19.) Extends from the Murchison River gorge (27°34' S, 114°27' E) south to Margaret River (33°57' S, 115°04' E), inland to Wogarl (31°54' S, 118°31' E) and east to near Mt Ney (33°34' S, 122°28' E).

Habitat. Occurs usually in sand or sandy clay, sometimes in clay or with gravel, often associated with granite outcrops or sheets or with seasonally waterlogged depressions, sometimes in sandplain.

Flowering period. Mainly September-December, also recorded in August and February.

Affinities. Close to and tending to intergrade with each of the other varieties in Western Australia and possibly even more closely related to the South Australian variety.

Notes. This is by far the most widespread and variable of the varieties. Many herbarium specimens are female. It appears that there are approximately equal numbers of bisexual and female plants in the wheatbelt areas but probably more bisexual than male plants in the more humid parts of the range.

A further syntype examined was Phillips River, date unknown, *G. Maxwell* (K). This is not cited above because it appears to be closer to *P. imbricata* var. *imbricata*.

One of the names given in the nomina dubia, *Pimelea imbricata* var. *nana* (Graham) C.H. Ostenfield was published prior to *P. imbricata* var. *piligera* and should possibly be applied to this taxon. However, no type specimen was found for the former and the original description of *P. nana* Graham was not sufficiently detailed to allow a definite identification.

13d. var. **petraea** (Meissner) Rye, comb. et stat. nov.

Pimelea petraea Meissner, Linnaea 26: 347 (1854). — *Banksia petraea* (Meissner) Kuntze, Revis. Gen. Pl. 583 (1891). — *Pimelea octophylla* subsp. *petraea* (Meissner) Threlfall, Brunonia 5: 178 (1983). *Type:* near Cudnaka, South Australia, 1851, *F. Mueller* (lecto, fide S. Threlfall, loc. cit.: MEL, n.v.).

A description of this taxon, which does not occur in Western Australia, is given by Threlfall, loc. cit.

Specimens examined. SOUTH AUSTRALIA (selected from over 40 seen): Mt Yardea, Gawler Range, *P.G. Wilson* 558 (AD, PERTH); Yorke Peninsula, 1879, *Tapper* (MEL).

Distribution. (Figure 20.) Occurs in southern South Australia in the Eyre Peninsula, Flinders Ranges and Yorke Peninsula.

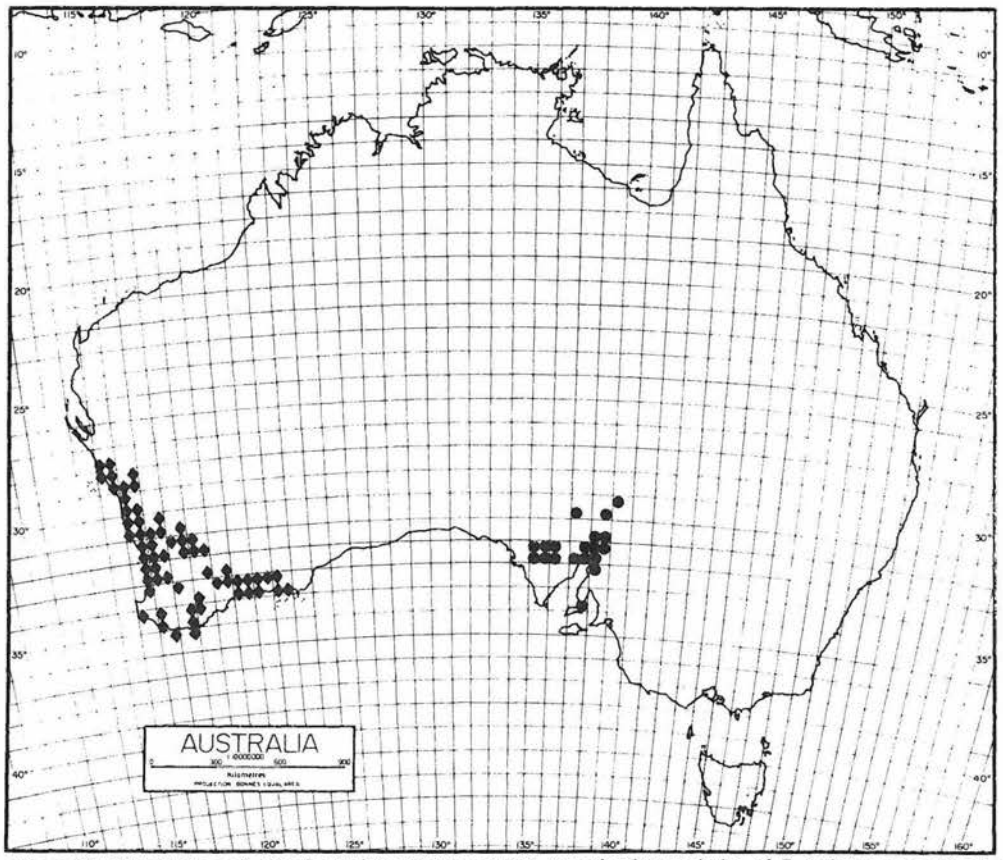

Figure 20. Distribution of *Pimelea imbricata* var. *petraea* ● and other varieties of *P. imbricata* combined ◆

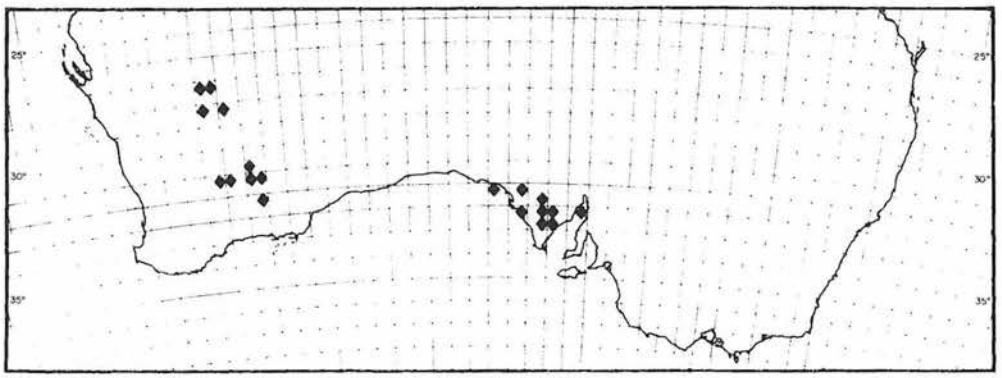

Figure 21. Distribution of *Pimelea subvillifera.*

14. **Pimelea subvillifera** (Threlfall) Rye, comb. et stat. nov.

Pimelea octophylla subsp. *subvillifera* Threlfall, Brunonia 5: 179 (1983). *Type:* S and SW of the Gawler Range area, South Australia, Oct. 1955, *R. Higginson* (holo: AD, n.v., fide S. Threlfall, Brunonia 5: 179 (1983)).

[*Pimelea villifera* auct. non Meissner: J. Black, Fl. S. Australia 1st edn 3: 400 (1926) and 2nd edn 3: 588 (1952).]

Shrub, usually erect, 0.2-0.7 m high, single- or multi-stemmed at ground level. *Stems* yellow-brown to red-brown and densely hairy near each inflorescence (but the colour somewhat hidden by hairs), becoming medium brown to almost black and glabrous further from apex. *Leaves* alternate, sessile or with a petiole up to 0.3 mm long; lamina concolorous, usually pale to medium grey-green or yellowish green, elliptic or sometimes narrowly elliptic, 2-7 x 1-2.5 mm, flat or adaxially concave, obtuse, densely hairy; hairs on abaxial surface longer and coarser than those on adaxial surface, the longest ones 1-2 mm long. *Peduncle* 0.5-4 mm long. *Involucral bracts* 8-18, the same colour as leaves, narrowly ovate to almost ovate, 4-9 x 1-2.5 mm, densely hairy; hairs similar to those on leaves. *Inflorescence* erect, compact. *Pedicels* up to 0.3 mm long; longest hairs 1-1.5 mm long. *Flowers* female or bisexual, white, densely hairy outside, with hairs 0.1-0.3 mm long inside distal part of floral tube; tube 5-8 mm long in bisexual flowers and 4-5 mm long in female flowers, probably not circumscissile. *Ovary-portion of floral tube* 1.5-2 x c. 0.5 mm; hairs antrorse, 3-5.5 mm long in bisexual flowers and 2.5-4 mm long in female flowers. *Style-portion of floral tube* 3-6 mm long in bisexual flowers and 2-3 mm long in female flowers, 0.5-0.7 mm diam. at summit, with a mixture of long and much shorter hairs, the longest hairs 1-2.5 mm long. *Sepals* ovate, 1.7-2.5 mm long in bisexual flowers and 1.3-2 mm long in female flowers, glabrous inside; outside hairs similar to those on style-portion of tube. *Stamens* shorter than or rarely slightly exceeding sepals; filament 1-1.8 mm long; anther 0.6-1 x 0.3-0.5 mm; connective slightly narrower than anther; slits usually more or less adaxial. *Staminodes*: filament 0.2-0.6 mm long; anther 0.2-0.4 x 0.1-0.2 mm. *Ovary* hairy at summit; longest hairs 0.8-1.2 mm long. *Style* exserted by 0.5-2 mm in bisexual flowers and 2-4 mm in female flowers. *Seed* c. 2.5 x 1 mm, with faint longitudinal markings.

Specimens examined. WESTERN AUSTRALIA: N of Esperance, Oct. 1903, *C. Andrews* (PERTH); 6 mi [9.5 km] W of Agnew, *J.S. Beard* 6580 (PERTH); Lake Cowan, NW of Norseman, *N.T. Burbidge* 2733 (CANB); 10 mi [16 km] E to SE of Sandstone, 1960, *Cole* (PERTH); near Lake Lefroy, 1893, *E. Cronin* (MEL); near Southern Cross, *A. Fairall* 2424 (CANB); between Red Kangaroo Hill and Yilgarn, Nov. 1891, *R. Helms* (MEL); near Lake Lefroy, Nov. 1891, *R. Helms* (AD); 9 km NE of Norseman, *K. Newbey* 7530 (PERTH); 52 mi [84 km] W of Coolgardie, 17 Sept. 1962, *M.E. Phillips* (CBG); 65 mi [105 km] NW of Sandstone towards Wiluna, *R.D. Royce* 10931 (PERTH); N of Sandstone, W of Old Gidgee Homestead, *R.D. Royce* 10453 (PERTH); Coolgardie, 1900, *L.C. Webster* (BRI); 27 mi [43 km] S of Coolgardie on road to Norseman, 3 Oct. 1961, *J.H. Willis* (MEL).

SOUTH AUSTRALIA (selected from c. 10 seen): c. 48 km W of Kimba, *R. Hill* 640 (AD).

Distribution. (Figure 19, 21.) In Western Australia recorded from north of Sandstone (27°10' S, 119°40' E) to near Norseman (32°12' S, 121°46' E). Also occurs in South Australia.

Habitat. Recorded in sandplain or on rocky hillsides.

Flowering period. September-November.

Affinities. Closest to *Pimelea imbricata*. Apart from the differences indicated in the key, *Pimelea subvillifera* tends to be more densely hairy throughout than *P. imbricata*. Its involucral bracts are always green, never having the red-purple tints often occurring in *P. imbricata*, and female plants are more common in *P. subvillifera*. In Western Australia *P. subvillifera* tends to have shorter stamens and the anther slits more adaxial than in *P. imbricata* but this difference is not so evident in South Australia.

Notes. Female and bisexual plants appeared to be approximately equal in frequency in Western Australian collections whereas only one of the South Australian specimens examined was bisexual, the others all being female.

15. **Pimelea villifera** Meissner in Lehm., Pl. Preiss. 2: 271-272 (1848). — *Calyptrostegia villifera* (Meissner) Walp., Annales Botanices Systematicae 3: 324 (1852). — *Banksia villifera* (Meissner) Kuntze, Revis. Gen. Pl. 2: 583 (1891). — *Pimelea imbricata* var. *villifera* (Meissner) Domin, Vestn. Kral. Ceske. Spolecn. Nauk. Tr. Mat.-Prir. 76 (1923). *Type:* south-western Australia, 1843-1844, *J. Drummond* coll. 3, n. 239 (iso: MEL, NY).

Shrub, erect, 0.2-1 m high, single-stemmed at ground level. *Stems* moderately to densely hairy and red-brown to grey near each inflorescence (but appearing whitish or silvery if hairs dense), becoming dark grey and glabrous further from apex, the hairs all short or some short and others much longer; short hairs antrorse or sometimes patent, 0.1-0.3 mm long; long hairs patent, 1-2 mm long (usually c. 1 mm). *Leaves* opposite, antrorse or patent; petiole 0.2-1 mm long; lamina concolorous, pale green to dark bluish green, usually medium green or blue-green, usually linear to narrowly elliptic, rarely elliptic to almost oblong, (3-)6-21 x (0.4-)0.8-4 mm, flat or adaxially concave, obtuse to almost acute, glabrous to densely hairy, usually at least sparsely hairy at first, sometimes only ciliate or with a few other hairs occurring abaxially especially on midrib, usually becoming glabrous; hairs appressed to antrorse, those on abaxial surface and margin 1-2(-2.5) mm long, those on adaxial surface up to 1 mm long. *Peduncle* 0.5-3 mm long. *Involucral bracts* usually in 6-10 pairs, becoming reflexed in fruit, similar in colour (except at base) to leaves or, if densely hairy, then silvery, with a prominent yellow or yellowish midrib at base, narrowly ovate to more or less narrowly oblong or rarely almost ovate, 5-18 x 1-3.5 mm, sparsely to densely hairy throughout or sometimes partially glabrous; hairs appressed to antrorse, usually not spreading as widely laterally from the margin as in *Pimelea imbricata*, often of very varied sizes, the longest ones 0.7-1.5 mm long. *Inflorescence* erect, compact. *Pedicels* 0.1-0.2 mm long; hairs up to 1.5 mm long. *Flowers* bisexual, rather dark-coloured at base, white above; tube 3.5-7 mm long, circumscissile 0.5-1 mm above ovary-portion. *Ovary-portion of floral tube* 1.25-2.5 x c. 0.7 mm, glabrous in basal 0.2-1 mm outside, densely hairy above; hairs appressed to antrorse, the longest ones 1.3-2.5 mm long. *Style-portion of floral tube* cylindric or narrowly cylindric, 2.25-4.5 mm long, c. 1.2 mm diam. at summit, densely hairy outside, hairy inside above circumscission point; indumentum on outside sometimes entirely or almost entirely of patent hairs mostly 0.1-0.3 mm long, usually also with a few antrorse hairs 0.6-0.9(-1.5) mm long; hairs on inside patent, c. 0.25 mm long. *Sepals* ovate or narrowly ovate, 1.5-3.5 mm long, often sparsely to densely hairy inside, the longest hairs shorter than those on outside; indumentum on outside similar to that on distal portion of floral tube but always with long hairs, which are usually more coarse than those on tube, the longest hairs 1-1.5(-2) mm long. *Stamens* longer than sepals; filament 2.5-4 mm long; anther 0.5-0.8 x 0.25-0.3 mm; connective narrower than anther; slits semi-lateral after dehiscence. *Ovary* with appressed to antrorse hairs 0.1-0.2 mm long, the hairs often occurring throughout but concentrated in the distal region. *Style* exserted by 3-5 mm. *Seed* c. 2.5 x 1 mm, with longitudinal rows of small but well defined pits. (Figure 22.)

Specimens examined. WESTERN AUSTRALIA: 2 mi [3 km] inland from coast near Lake Logue, W of Eneabba, *J.S. Beard* 7310 (PERTH); 15 km NE of Cervantes, *M. Fagg* 1009 (PERTH); Cunderdin, Nov. 1903, *W.V. Fitzgerald* (PERTH); Darling Range, 1881, *J. Forrest* (MEL); Mt Stirling, Nov. 1928, *C.A. Gardner* (PERTH); Wongan Hills, *E.H. Ising* 157 (AD); 13 km E of Cervantes, *G.J. Keighery* 4587 (PERTH); Wongan Hills, *K.F. Kenneally* 2433 (PERTH); Monks Well Gully, Wongan Hills, *K.F. Kenneally* 5883 (PERTH); between Elphin Siding and the Television Translator Tower, Wongan Hills, *K.F. Kenneally* 7159 (PERTH); gap below Television Translator Tower, Wongan Hills, *K.F. Kenneally* 8846 (PERTH); Television Translator Tower, Wongan Hills, *K.F. Kenneally* 8857 (PERTH); Gutha, date unknown, *K.W. McLean* (UWA); 15 mi [24 km] S of Tammin, *R.D. Royce* 9349 (PERTH); Wambyn Rd, W of York, 4 Apr. 1984, *J. Seabrook* (PERTH); 18 km NE of Cervantes, *A. Strid* 21675 (PERTH); 6 km NW of Wongan Hills, *A. Strid* 21728 (PERTH); c. 8 mi [13 km] from York, collector unknown (PERTH).

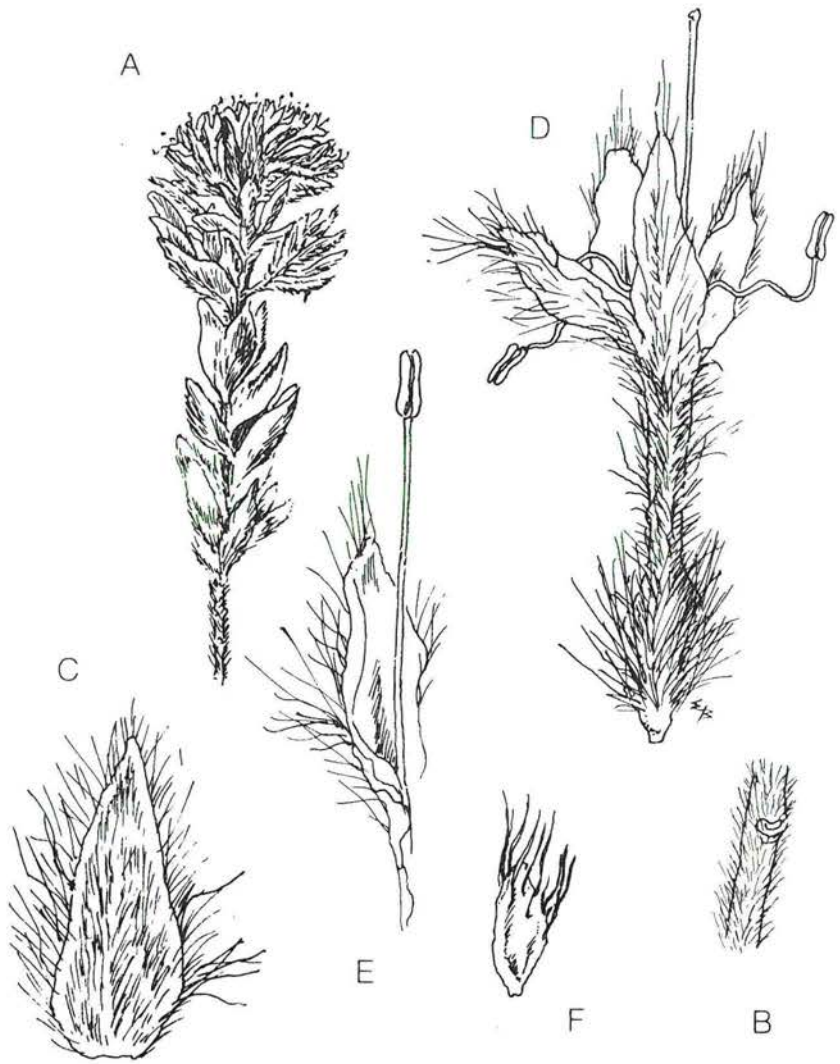

Figure 22. *Pimelea villifera*, a variant matching the type specimen. A- flowering stem; B- portion of stem (x 3); C- outer surface of bract (x 5); D- flower (x 10); E- stamen (x 12); F- ovary (x 12). Drawn from *C.A. Gardner* (Mt Stirling, Nov. 1928).

Distribution. (Figure 18.) Extends from Gutha (29°00' S, 115°57' E), south-west to near Cervantes (c. 30°31' S, 115°04' E) and south to Tammin Flora Reserve (c. 31°39' S, 117°30' E).

Habitat. Occurs in varied habitats. Recorded in sand, sometimes on limestone pavements, near the coast. Most commonly collected from lateritic soils, often with outcropping laterite, in the Wongan Hills, the Darling Range and at York. Also occurs on granite outcrops or in sand in more inland localities.

Flowering period. October-April, especially November-February.

Affinities. Closest to *Pimelea erecta*, the differences between the two species being noted under *P. erecta*.

Notes. A very variable species. The type specimen matches specimens from granite outcrops in the wheatbelt. These have very densely hairy stems, leaves, bracts and flowers, relatively broad leaves and the style-portion of the floral tube has more long hairs than in specimens from other areas. They superficially resemble, and may be confused with, *Pimelea imbricata* var. *piligera.* Specimens of *P. villifera* from near the coast have sepals that are densely hairy on both surfaces.

16. **Pimelea erecta** Rye, sp. nov. (Figure 23.)

Affinis *P. villiferae* Meissner sed differt caulibus glabris, involucri bracteis minus numerosis, sub fructu non deflexis.

Typus: By tributary of Young River, c. 80 km W of Esperance, 33°28' S, 121°09' E, Western Australia, 28 Sept. 1968, *P.G. Wilson* 8025 (holo: PERTH; iso: CANB, K, MEL, NSW).

Related to *P. villifera* Meissner but differs in the glabrous stems and less numerous involucral bracts, which do not become reflexed in fruit.

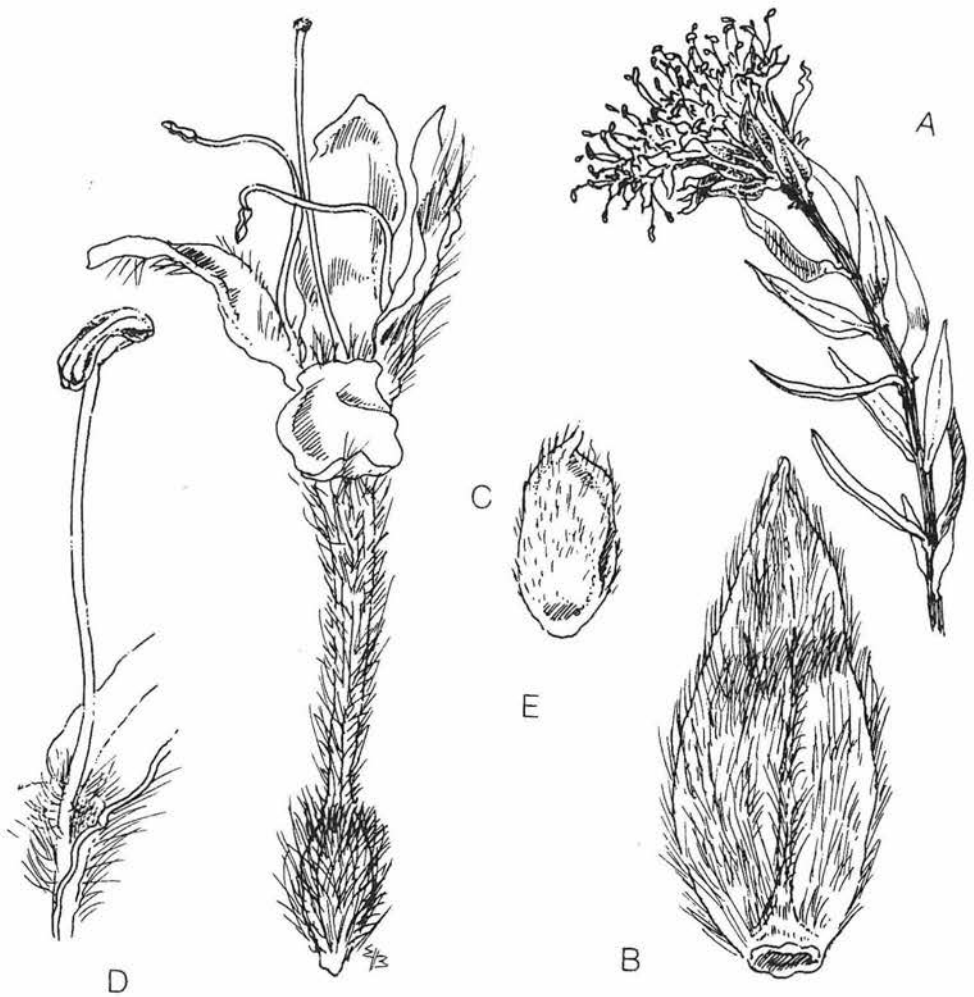

Figure 23. *Pimelea erecta.* A- flowering stem; B- inner surface of bract (x 6.5); C- flower (x 10); D- stamen (x 15); E- ovary (x 17). Drawn from fresh material represented by *K. Newbey* 9848.

Shrub, erect, often spreading, 0.3-1(-2) m high, single-stemmed at ground level. *Stems* pale brown and usually partly reddish near each inflorescence, becoming dark grey or dark grey-brown further from apex, glabrous except for axillary hairs or without axillary hairs. *Leaves* opposite, antrorse to patent, glabrous; petiole 0.4-1 mm long; lamina concolorous, medium green, usually elliptic to ovate or narrowly so, rarely very narrowly elliptic, 5-20 x 1.5-5 mm, flat or adaxially concave, acute or narrowly obtuse. *Peduncle* 1-8(-15) mm long. *Involucral bracts* usually 8 or 10, not becoming reflexed, dark reddish at base but otherwise similar in colour to leaves, ovate to elliptic, 5-11 x 1.3-4 mm, glabrous outside, densely appressed-hairy inside, densely ciliate; hairs (including the cilia) up to 0.4 mm long. *Inflorescence* erect, compact. *Pedicels* 0.1-0.2 mm long; longest hairs 1-1.5 mm long. *Flowers* bisexual, usually white or off-white, sometimes pale pink; tube 6-8 mm long, circumscissile and rather constricted c. 0.5 mm above ovary-portion. *Ovary-portion of floral tube* 2-3 x c. 1 mm, glabrous at base outside and densely hairy above, glabrous inside; hairs appressed to antrorse, 1.5-2 mm long. *Style-portion of floral tube* 3.5-5 mm long, 1.2-2 mm diam. at summit, densely hairy outside, rather densely hairy inside; hairs on outside antrorse, all rather uniform and short or some minute and others much longer, the shortest usually 0.1-0.2 mm long, the longest up to 1 mm long; hairs on inside occurring throughout the expanded part of the style-portion, patent, the longest hairs c. 0.4 mm long. *Sepals* ovate or nearly so, 2.5-3.5 mm long, densely hairy outside, the indumentum similar to that on distal part of floral tube or with a greater proportion of long hairs, densely hairy in basal third inside, rather densely hairy (along middle) to glabrous above. *Stamens* longer than sepals; filament 3-5 mm long; anther 0.8-1 x 0.2-0.4 mm; connective rather broad but narrower than anther; slits semi-lateral after dehiscence. *Ovary* sparsely to rather densely hairy, with minute hairs 0.1-0.2 mm long throughout and larger hairs 0.4-1 mm long at summit. *Style* exserted by 3-4.5 mm. Mature *seed* not seen.

Specimens examined. WESTERN AUSTRALIA (selected from over 40 seen): near Salmon Gums, *W.E. Blackall* 1004 (PERTH); c. 3 mi [5 km] SE of Mt Ragged, *A.S. George* 2125 (PERTH); 15 km SW of Newdegate, *J.M. Koch* 89 (PERTH); 6 mi [10 km] S of Forrestiana cross roads, *F. Lullfitz* 3971 (PERTH); Frank Hann National Park, *D. Monk* 186 (PERTH); 2.5 mi [4 km] NW of Ongerup, *K. Newey* 70 (PERTH); 1 mi [1.5 km] N of Hopetoun, *M.E. Phillips* 623004 (PERTH); Perkins Rock, Fitzgerald River National Park., *R.D. Royce* 9212 (PERTH); Israelite Bay, 27 Nov. 1950, *J.H. Willis* (MEL); Hopetoun, 27 Oct. 1968, *J.W. Wrigley* (BRI, CBG); Esperance, near Pink Lake, 30 Oct. 1968, *J. Wrigley* (CBG, PERTH).

Distribution. (Figure 25.) Extends from Ongerup (33°56' S, 118°28' E) east to Israelite Bay (33°37' S, 123°52' E).

Habitat. Occurs in sand or clay, sometimes recorded in open mallee woodland.

Flowering period. July-March, especially October-January.

Derivation of name. Erectus (L.) — upright, referring to the erect inflorescence and involucral bracts, the latter, unlike the bracts of several related species, not becoming reflexed in fruit.

Affinities. A much less variable species than its closest relative, *Pimelea villifera.* The involucral bracts of *P. erecta* differ from those of *P. villifera* in being less hairy, having a less prominent midrib and being reddish at the base on the outside. Other differences are given in the diagnosis.

17. **Pimelea sylvestris** R. Br., Prodr. 361 (1810). — *Calyptrostegia sylvestris* (R. Br.) C. Meyer, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 74 (1845). — *Banksia sylvestris* (R. Br.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* King George Sound, Western Australia, Dec. 1801, *R. Brown* (BM, MEL).

Pimelea graciliflora Hook, Bot. Mag. 60: t. 3288 (1833). — *Calyptrostegia graciliflora* (Hook.) Endl., Gen. Pl. Suppl. 4: 61 (1848). *Type:* Illustration t. 3288.

Shrub, erect, 0.3-2 m high, single-stemmed at ground level. *Stems* very pale to medium green or pale brown or rarely dark purplish near each inflorescence, becoming red-brown or dark grey-brown further from apex, glabrous except for axillary hairs. *Leaves* opposite, glabrous; petiole 0.5-2.2 mm long; lamina concolorous or paler on abaxial surface, medium green on adaxial surface, usually narrowly elliptic to elliptic, 12-45 x 2.5-12(-20) mm, flat or adaxially concave, rather acute. *Peduncle* 5-65 mm long. *Involucral bracts* usually 6, sometimes 4 or 8, usually becoming reflexed in fruit, either the same colour as leaves or purplish on the abaxial surface, narrowly ovate or rarely ovate, 8-22 x 2-10 mm, glabrous. *Inflorescence* erect, compact. *Pedicels* usually 0.5-0.8 mm long; hairs 1.5-2 mm long. *Flowers* bisexual, dark-coloured below circumscission point, white or pink above, glabrous outside; tube 7-14 mm long, circumscissile 0.3-1 mm above the ovary-portion. *Ovary-portion of floral tube* 2-3 x 1-1.5 mm, glabrous. *Style-portion of tube* distinctly expanding in distal half, 5-11 mm long, 0.8-2 mm diam. at summit, hairy in expanded part inside, glabrous below; hairs usually patent, somewhat curved or curly, 0.2-0.6 mm long. *Sepals* ovate, 2.5-6 mm long, glabrous. *Stamens* slightly to greatly exceeding sepals; filament 3-6.5 mm long; anther 0.8-1.5 x c. 0.3 mm; connective much narrower than anther; slits semi-lateral after dehiscence. *Ovary* hairy at apex; hairs 0.2-0.4(-0.7) mm long. *Style* exserted by 3-7 mm. *Seed* 3-5 x 1.4-2.2 mm, with longitudinal rows of well defined shallow pits. (Figure 24.)

Specimens examined. WESTERN AUSTRALIA (selected from c. 100 seen): Stirling Range, *A.M. Ashby* 659 (AD); Augusta, *A.M. Ashby* 2686 (AD, PERTH); 6 mi [9.5 km] inland from Cervantes, *J.S. Beard* 7841 (NSW, PERTH); Bolder Rock area, *R.J. Cranfield* 1970 (PERTH); Banksiadale Dam, *H. Demarz* 4135 (PERTH); between Gardner River and West Mt Barren, *A.R. Fairall* 2320 (PERTH); Mt Bakewell, York, *C.A. Gardner* 1028 (PERTH); Nancy Peak, Porongurup Range, *T. E. George* 493 (MEL); near Boggy Lake, 6 mi [9.5 km] SW of Walpole, *J.W. Green* 1088 (PERTH); Eneabba Flora Reserve, 12 Sept. 1963, *A. Kessell* (PERTH); Wooroloo, *M. Koch* 1836 (MEL); Donnybrook, *M. Koch* 2090 (MEL); Cape Leeuwin, *F. Lullfitz* 2053 (PERTH); Smiths Mill [Glen Forrest], *A. Morrison* 7202 (BRI, PERTH); Canning River, near crossing of Aschendon Rd, *A.E. Orchard* 4287 (AD, PERTH); Karridale, *R.D. Royce* 4674 (PERTH); Mt Bakewell, York, *B.L. Rye* 82008 (PERTH); road to Point Nuyts near bridge, 14 Oct. 1968, *J. Wrigley* (CBG, MEL).

Distribution. (Figure 25.) Extends from near Coolimba (29°52' S, 114°59' E) south to near Cervantes (c. 30°25' S, 115°10' E) and from Parkerville (31°53' S, 116°08' E) around the coast to near West Mt Barren (c. 45°15' S, 119°25' E) and inland to Mt Bakewell (31°51' S, 116°45' E).

Habitat. Mainly occurs in woodland or forest, often in gullies or on hills, recorded in lateritic and granitic areas. However, populations from Coolimba to Cervantes occur in coastal shrublands associated with limestone.

Flowering period. Mainly September-December.

Affinities. Closest to *Pimelea calcicola.*

Notes. Pimelea graciliflora is regarded here as being conspecific with *P. sylvestris.* It was regarded by some authors, such as Beard (1970), as being a related species, which has now been named *P. calcicola* (Rye 1985). As no type specimen has been located for *P. graciliflora,* the type description and illustration must be relied upon to identify the species. The taxon was reportedly grown from seed collected at King George Sound. Its flower colour and stamens were typical of *P. sylvestris* but the illustration suggests that the floral tube was more cylindrical

Figure 24. *Pimelea sylvestris*. A- flowering stem with bracts reflexed; B- flower (x 8); C- stamen and opened floral tube (x 9); D- ovary (x 12). Drawn from *R.J. Cranfield* 1970.

than usual. *Pimelea sylvestris* typically has pure white flowers, although some specimens are pale pink or pink-tinged, and its floral tube shows a more obvious expansion at the summit than in *P. calcicola*. In *P. sylvestris*, the involucral bracts become reflexed in fruit and are often dark purple or black on the abaxial surface. The anthers are more elongate than in *P. calcicola*, with a narrower connective and the anther slits semi-lateral after dehiscence

rather than adaxial. In *P. sylvestris* the anthers are orange whereas in *P. calcicola* the anthers are only orange on the inside at dehiscence, then becoming deep pink to purple throughout.

Specimens of *Pimelea sylvestris* from Mt Bakewell, near York, have very large leaves and flowers. Pink-flowered specimens have only been recorded from near the south coast.

18. **Pimelea calcicola** Rye, Nuytsia 5: 4-6 (1984). *Type:* Cromford Way, Carine, Perth, Western Australia, 31°50' S, 115°45' E, 10 Oct. 1983, *N. Cohen* 1007 (holo: PERTH; iso: CANB, K, MEL, NSW).

[Pimelea graciliflora auctt. non Hook.; e.g. Meissner in Lehm, Pl. Preiss. 1: 605 (1845).]

Shrub, erect, 0.2-1 m high, single-stemmed at ground level, bushy above. *Stems* pale green and sometimes pink-tinged near each inflorescence, becoming red-brown then grey further from apex, glabrous except for axillary hairs. *Leaves* opposite, antrorse to patent, glabrous; petiole 0.7-1.5 mm long; lamina concolorous, pale to medium green, narrowly elliptic to elliptic, (4-)13-27 x (1-)3-7 mm, flat or adaxially distinctly concave, acute to almost obtuse. *Peduncle* (2-)5-20(-25) mm long. *Involucral bracts* 6 or sometimes 8, closely surrounding flowers, not becoming reflexed, similar to leaves in colour and texture, ovate or nearly so, 9-19 x 4-8 mm long, glabrous. *Inflorescence* erect, compact. *Pedicels* 0.5-1 mm long; hairs 1.5-2 mm long. *Flowers* bisexual, pale to deep pink, the proximal half often more deeply coloured than distal half; tube 12-16 mm long, circumscissile 0.5-1.5 mm above ovary-portion. *Ovary-portion of floral tube* 3-4 x 1-1.5 mm, glabrous. *Style-portion of floral tube* narrowly cylindric, expanding only slightly throughout its length, 9-12 mm long, 1-1.5 mm diam. at summit, glabrous outside,

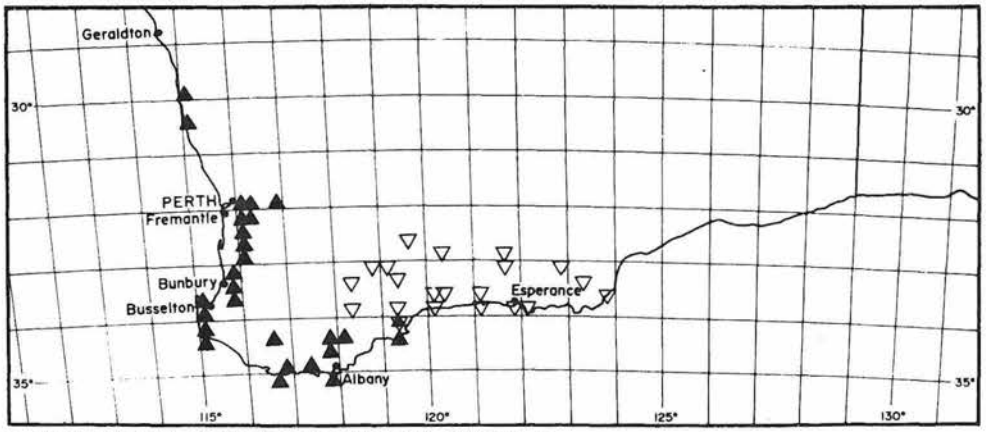

Figure 25. Distribution of *Pimelea erecta* ∇ and *P. sylvestris* ▲.

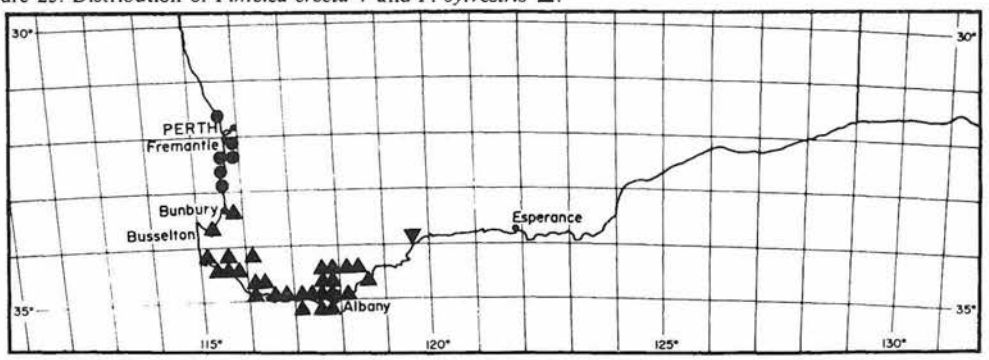

Figure 26. Distribution of *Pimelea calcicola* ●, *P. longiflora* subsp. *eyrei* ▼ and *P. longiflora* subsp. *longiflora* ▲.

hairy inside in the distal half, the circumscission point often distinctively coloured; hairs mostly patent, often curved, 0.3-0.6(-0.8) mm long. *Sepals* ovate, 2-4 mm long, glabrous. *Stamens* longer or rarely shorter than sepals; filament 2-3 mm long; anther 0.5-0.8 x 0.3-0.5 mm; connective very broad but slightly narrower than anther; slits strictly adaxial. *Ovary* hairy at summit; hairs 0.5-0.7 mm long. *Style* exserted by 4-7 mm. *Seed* c. 4 x 2 mm, with longitudinal furrows. (Figure — Rye 1984: 5.)

Specimens examined. WESTERN AUSTRALIA (selected from over 25 seen): Mandurah, Aug. 1961, *J. Burbidge* (CANB); 29.6 mi [48 km] S of Fremantle, 3 Oct. 1968, *E.M. Canning* (CBG); Mandurah, *C.F. Davies* 138 (PERTH); Burns Beach Rd, *H. Demarz* 359 (PERTH); Madora Beach settlement, *B. Haberley* 201 (PERTH); North Fremantle, 3 Nov. 1897, *R. Helms* (PERTH); Yanchep National Park, *A.M. James* 49 (PERTH); 24 mi peg [38 km] on Yanchep road, *F. Lullfitz* 3700 (PERTH); The Plains, near Mandurah, *V. Mann & A.S. George* 32 (PERTH); near Coogee, date unknown, *F. Mueller* (MEL); Yalgorup National Park, *S. Paust* 1341 (PERTH); Yanchep National Park, 27 Oct. 1962, *M.E. Phillips* (CBG); Carine, *B.L. Rye* 82014 (PERTH); N of Wanneroo, *F.G. Smith* 1584. (PERTH); Victoria Park, date unknown, *J.L. Steedman* (NSW).

Distribution. (Figure 26.) Extends from Yanchep National Park (31°32' S, 115°40' E) south of Yalgorup National Park (32°50' S, 115°40' E).

Habitat. Occurs close to the coast associated with outcropping limestone, growing in sand.

Flowering period. September-November.

Affinities. Closest to *Pimelea sylvestris.*

Notes. See note under *Pimelea sylvestris.* The sepals are distinctly concave and do not spread as widely as in other Western Australian species in this section.

19. **Pimelea longiflora** R. Br., Prodr. 361 (1810). — *Calyptrostegia longiflora* (R. Br.) Endl., Gen. Pl. Suppl. 4: 61 (1848). — *Banksia longiflora* (R. Br.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* King George Sound, Western Australia, Dec. 1801, *R. Brown* (BM, MEL).

Shrub. erect, 0.3-1.3 m high, usually spindly, single-stemmed at ground level. *Stems* reddish brown and very densely hairy near each inflorescence, becoming medium brown to very dark brown and glabrous further from apex; hairs antrorse to patent, very fine, the longest ones 1-2 mm long, sometimes very variable in size and including minute hairs 0.1-0.3 mm long. *Leaves* opposite or alternate, sometimes crowded; petiole 0.2-1 mm long; lamina concolorous, medium to dark green, linear to elliptic, usually narrowly elliptic, 4-18 x 1-3 mm, adaxially concave, acute to obtuse, sparsely to densely hairy outside (but often appearing glabrous) when young, glabrous or densely hairy inside; hairs 1-4 mm long. *Peduncle* 2-20 mm long. *Involucral bracts* 4-6, becoming reflexed in fruit, similar to leaves in colour, narrowly ovate or ovate, 5-12 x 1.5-3 mm, sparsely to densely hairy on both surfaces or glabrous inside; hairs similar to those on leaves. *Inflorescence* erect, usually compact but sometimes becoming cylindric, the rachis up to 10 mm long. *Pedicels* usually 0.4-0.5 mm long; hairs up to 2.5 mm long, very fine. *Flowers* bisexual or very rarely female, brown below circumscission point, white or rarely cream above, glabrous inside floral tube and sepals; tube 7-12 mm long, circumscissile 0.5-1 mm above ovary-portion. *Ovary-portion of floral tube* 1.5-3 x c. 1 mm; hairs appressed to antrorse, the longest ones 1-1.5 mm long, slightly thicker than those on style-portion. *Style-portion of floral tube* very narrowly cylindric, 5.5-9 mm long, c. 1 mm diam. at summit, densely and uniformly hairy; hairs appressed to antrorse, up to 2mm long, very fine. *Sepals* narrowly ovate to ovate, 5-6 mm long, with similar hairs to those on distal

part of floral tube. *Stamens* subsessile at throat of flower; filament c. 0.25 mm long; 1.2-1.6 x 0.5-0.6 mm; connective very broad, slightly exceeding the cells laterally; slits strictly adaxial. *Staminodes* of female flowers: anther c. 0.5 mm long. *Ovary* with an erect terminal tuft of very fine hairs, glabrous or almost glabrous below; hairs up to 0.5 mm long, very fine. *Style* reaching the throat but not exserted in bisexual flowers, exserted by c. 1.5 mm in female flowers. *Seed* c. 3 x 1.7 mm, with longitudinal rows of very shallow pits. (Figure 27.)

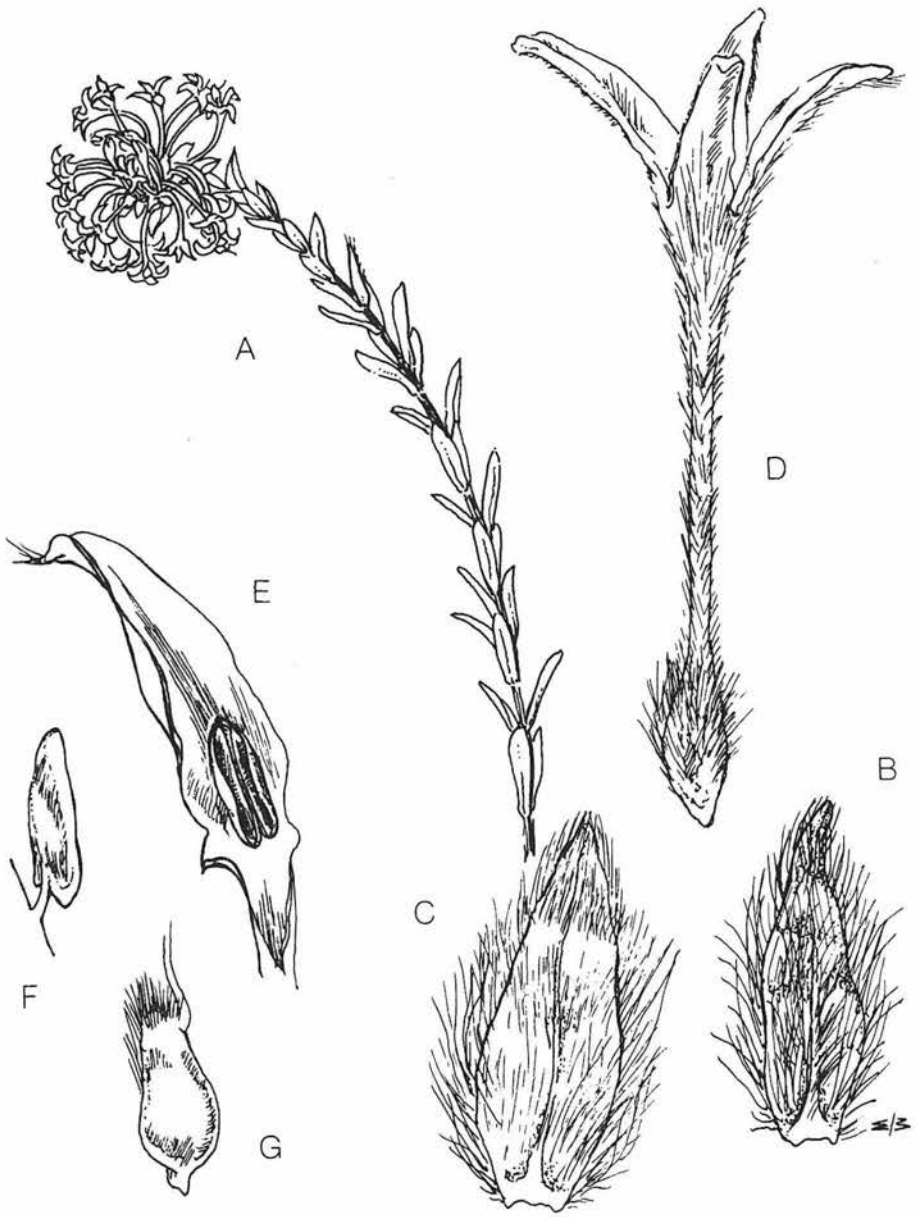

Figure 27. *Pimelea longiflora* subsp. *eyrei*. A- flowering stem; B- outer surface of leaf (x 6); C- inner surface of bract (x 6); D- flower (x 8); E-inner surface of stamen (x 12); F- side view of stamen (x 16); G- ovary (x 12). Drawn from fresh material represented by *K. Newbey* 9846.

Distribution. (Figure 26.) Extends from near Bunbury to Cape Riche, with a disjunct occurrence about 140 km to the north-east of the latter locality in Fitzgerald River National Park.

Flowering Period. August-February.

Affinities. Closest to *Pimelea preissii* but very distinctive. It is the only Western Australian species of sect. *Calyptrostegia* in which the inflorescence sometimes becomes elongate.

Notes. Two subspecies are recognised.

Key to Subspecies

1. Young leaves densely hairy on both surfaces. Bracts densely hairy inside ..... 19a. subsp. *eyrei*
1. Young leaves hairy on abaxial surface, adaxially glabrous or sparsely hairy. Bracts glabrous inside ..... 19b. subsp. *longiflora*

19a. subsp. **eyrei** (F. Muell.) Rye, comb. et stat. nov. (Figure 27.)

Pimelea eyrei F. Muell., Fragm. 5: 109 (1866). — *Banksia eyrei* (F. Muell.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* Eyre Range, Phillip River and Fitzgerald River, Western Australia, date unknown, *G. Maxwell* (holo: MEL).

Leaves: lamina narrowly elliptic or sometimes elliptic, 5-9 x 1.5-2.5 mm, conspicuously hairy and appearing silvery when young; hairs dense on both surfaces of leaf, up to 4 mm long. *Involucral bracts* slightly flatter than the leaves below, with similar hairs to those on leaves. *Flowers* white or cream; hairs up to 2 mm long.

Specimens examined. WESTERN AUSTRALIA: N of Hamersley River estuary, *A.S. George* 7222 (PERTH); 7 km W of East Mt Barren, *K. Newbey* 9470 (PERTH); Hamersley Drive, 3 km N of track of Hamersley Inlet, *J. Taylor* 1730 & *P. Ollerenshaw* (CBG, MEL, PERTH).

Distribution. (Figure 26.) Extends from the Bremer River (c. 34°10' S, 119°04' E) to Hamersley Inlet (33°57' S, 119°55' E), in the Fitzgerald River National Park.

Habitat. Recorded in sand, often on quartzite ridges, in low shrublands.

Flowering period. August-November.

19b. subsp **longiflora**

Calyptrostegia villosa Turcz., Bull. Soc. Imp. Naturalistes Moscou 25/2: 178 (1852) — *Pimelea villosa* (Turcz.) Meissner in DC., Prodr. 14: 508 (1857). *Type:* south-western Australia, 1848, *J. Drummond* coll. 5, n. 428 (iso vel syn: K, MEL, NY).

Pimelea longiflora var. *latifolia* Benth., Fl. Austral. 6: 34 (1873). *Type:* south-western Australia, 1848, *J. Drummond* coll. 5, n. 428 (holo: K, iso vel syn: MEL, NY).

Leaves: lamina linear to narrowly elliptic, 4-18 x 1-3 mm, glabrous on adaxial surface or sometimes with a few hairs in leaves close below an inflorescence, sparsely to moderately hairy on abaxial surface when young but usually appearing glabrous, becoming glabrous with age; hairs up to 2.5 mm long. *Involucral bracts* tending to be shorter and broader than leaves, hairy (sometimes sparsely) outside, glabrous inside. *Flowers* usually white; hairs up to 1.5 mm long.

Specimens examined. WESTERN AUSTRALIA (selected from over 135 seen); 7 mi [11 km] S of Pemberton, *T.E.H. Aplin* 1387 (PERTH); Bayonet Head, Albany, *A.M. Ashby* 3112 (AD, PERTH); Mt Hamilla, *E.M. Canning* 6158 (CBG, MEL); c. 35 km W of Denmark, *H. Eichler* 16102 (AD); Parry Inlet, *C.A. Gardner* 13035 (PERTH); Bluff Knoll, *A.S. George* 412 (PERTH); 4 mi [6.5 km] N of Northcliffe, *A.S. George* 3183 (PERTH); 2.5 mi [4 km] W of Narrikup, *K.F. Kenneally* 71/262 (PERTH); 3 km S of Mount Barker, *K.F. Kenneally* 6941 (PERTH); Porongurup Range, *T.B. Muir* 3971 (MEL); Scott River, 21 Sept. 1973, *E.C. Nelson* (CANB, PERTH); Mt Mistake, 25 Sept. 1973, *E.C. Nelson* (CANB, PERTH); c. 10 km NE of Augusta, *A.E. Orchard* 4342 (AD, PERTH); Yoongarillup, *R.D. Royce* 3162 (PERTH); c. 2 km SW of the Stewart Rd-Brockham Highway intersection, *E.A. Shaw* 679 (AD); King George Sound, *R. Solivsbergh* 38 (BRI); 6 mi [9.5 km] from Australind to Brunswick Junction, 18 Aug. 1970, *G. Stone* (PERTH); Walpole, 6 Sept. 1947, *J.H. Willis* (MEL); 3 mi [5 km] inland from Two Peoples Bay, 24 Oct. 1965, *J.W. Wrigley* (CBG).

Distribution. (Figure 26.) Extends around the coast from Brunswick Junction (33°16' S, 115°48' E) to Cape Riche (34°36' S, 118°47' E) and inland to the Stirling Range.

Habitat. Occurs in sand or sandy clay, usually associated with seasonally waterlogged depressions.

Flowering period. August-February.

Notes. The type collection of *Pimelea longiflora* var. *latifolia (J. Drummond* coll. 5, n. 428) may be heterogeneous. The specimen at K has uniformly broad leaves whereas those at MEL and NY have all or most of the leaves narrow.

20. **Pimelea preissii** Meissner in Lehm., Pl. Preiss. 1: 601-602 (1845). — *Calyptrostegia preissii* (Meissner) Endl., Gen. Pl. Suppl. 4: 61 (1848). — *Banksia preissii* (Meissner) Kuntze, Revis. Gen Pl. 2: 583 (1891). *Type:* "Halfwayhouse" [The Lakes], Darling Range, Western Australia, 13 Sept. 1839, *L. Preiss* 1266 (presumed holo: LD; iso: MEL).

Shrub, 0.08-0.6(-1) m high, single-stemmed at ground level. *Stems* pale green or yellowish near each inflorescence, becoming dark reddish then grey further from apex, glabrous except for axillary hairs. *Leaves* opposite, glabrous; petiole 0.5-1.5 mm long; lamina concolorous, medium green, usually narrowly elliptic and 5-20 x 2-5 mm, sometimes ovate and up to 7 mm wide in leaves directly below an inflorescence, flat or adaxially somewhat concave, narrowly obtuse to acute. *Peduncle* 2-20 mm long. *Involucral bracts* 4, closely surrounding flowers, not becoming reflexed, medium green, ovate or broadly ovate, 6-14 x 4-10 mm, glabrous outside; outer bracts sometimes appressed-hairy inside; inner bracts more frequently appressed-hairy inside, often ciliate, the cilia 0.2-1 mm long. *Inflorescence* erect, compact. *Pedicels* 0.5-1.5 mm long; hairs 1-3 mm long. *Flowers* bisexual, white or pink or very rarely red, glabrous inside floral tube and sepals; tube 10-16 mm long, circumscissile 1-2.5 mm above ovary-portion. *Ovary-portion of floral tube* usually c. 3 x 1 mm, glabrous at base, with a dense mixture of long and minute hairs above; long hairs appressed to antrorse, 1-2 mm long; short hairs appressed to antrorse, c. 0.2 mm long. *Style-portion of floral tube* narrowly cylindric, 7-12 mm long, c. 1 mm diam. at summit, densely hairy; hairs antrorse, very fine, those above circumscission point at most 0.5-1 mm long, those below grading into the hairs of the ovary-portion. *Sepals* ovate or elliptic, 3-5 mm long, with hairs similar to those on distal part of tube. *Stamens* subsessile at throat of floral tube; filament 0.1-0.5 mm long; anther 1.1-1.8 x 0.3-0.7 mm; connective very broad, slightly exceeding the cells laterally; slits strictly adaxial. *Ovary* glabrous. *Style* not exserted. *Seed* at least 3 x 1.5 mm, apparently with irregular longitudinal furrows but not seen at maturity.

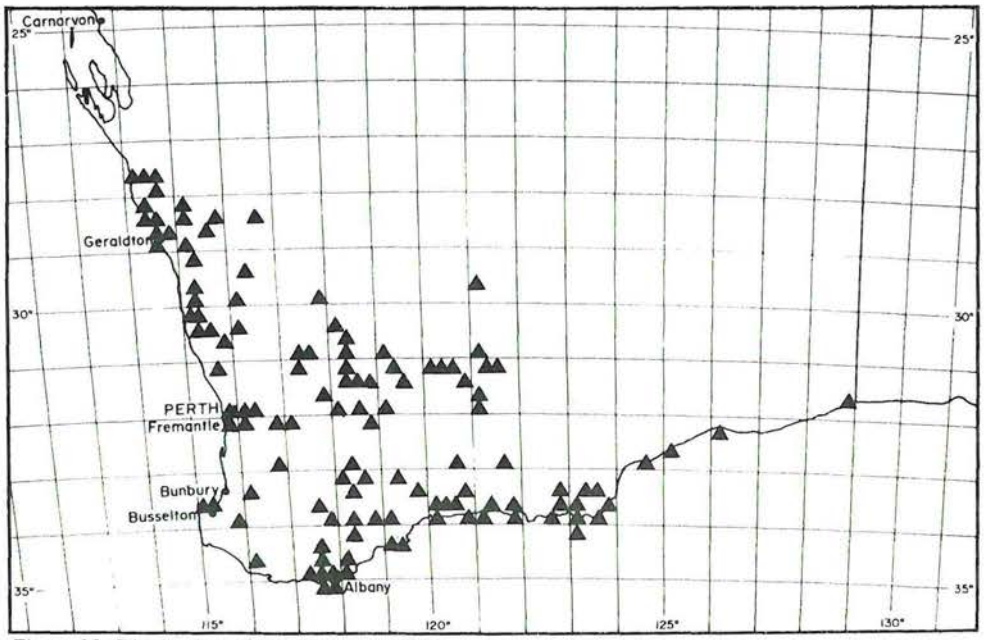

Figure 28. Distribution of *Pimelea angustifolia*.

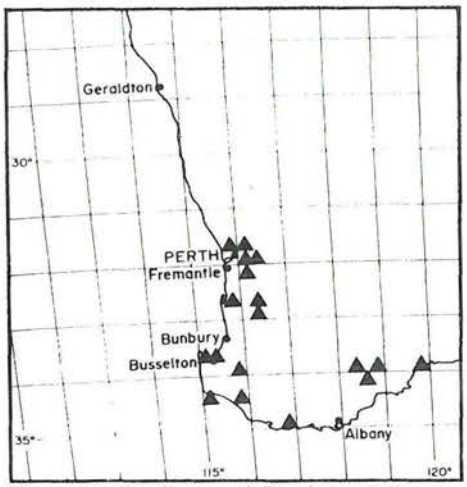

Figure 29. Distribution of *Pimelea preissii*.

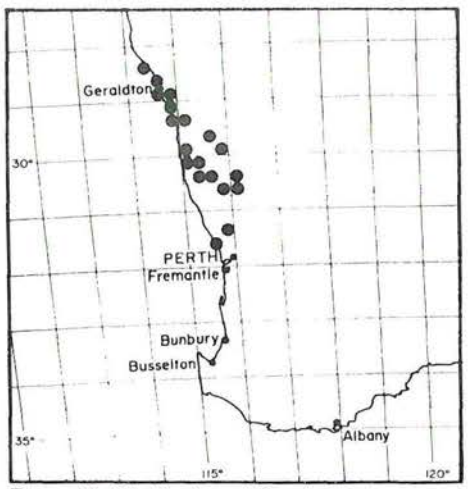

Figure 30. Distribution of *Pimelea floribunda*.

Specimens examined. WESTERN AUSTRALIA (selected from over 45 seen): Ruabon-Ludlow, *T.E.H. Aplin* 1182 (PERTH); near Nannup, *A.M. Ashby* 3694 (AD); Albany Hwy, 59.2 mi [94.5 km] S of Perth, *E.M. Canning* 3713 (CBG); 15.4 mi [25 km] from Pemberton towards Nannup, *E.M. Canning* 6518 (CBG); 15 km W of Dunsborough, *R.J. Cranfield* 935 (PERTH); c. 23 km NW of North Banister, *N.N. Donner* 1471 (AD); Frankland River, *C.A. Gardner* 13013 (PERTH); Bow River, Dec. 1912, *S.W. Jackson* (NSW, PERTH); Wooroloo, *M. Koch* 1755 (MEL); Mt Saddleback, 13 Nov. 1904, *A. Morrison* (PERTH); Needilup Hill, *K. Newbey* 1339 (PERTH); 16 km W of Kybulup Pool, West River, *K. Newbey* 11302 (PERTH); Albany Hwy, 28 mi [45 km] S of Perth, *M.E. Phillips* 1916 (CBG); Pinjarra, Oct, 1872, *J.L. Price* (MEL); Ambergate, *R.D. Royce* 3952 (PERTH); Helena Valley, *J. Seabrook* 394 (PERTH); 7 mi [11.5 km] E of Nannup, 12 Oct. 1961, *J.H. Willis* (MEL, PERTH).

Distribution. (Figure 29.) Extends at least from Wooroloo (31°48' S, 116°19' E) south to Cape Leeuwin (34°22' S, 115°08' E) and Bow River (34°55' S, 116°55' E) and from Ongerup (33°57' S, 118°29' E) east to West River (33°47' S, 119°47' E).

Habitat. In the Darling Range occurs in clay, usually in lateritic areas in *Eucalyptus* woodlands. South of the Darling Range occurs in sand, sometimes with lateritic gravel and sometimes associated with winter-wet depressions or watercourses, usually in *Eucalyptus* forests.

Flowering period. September-December.

Affinities. Close to *Pimelea longiflora* and to a lesser extent to *P. angustifolia.*

Notes. Specimens from the Ongerup — West River area are smaller in habit than specimens from the western part of the species range and also tend to have smaller bracts and flowers.

21. **Pimelea angustifolia** R. Br., Prodr. 360 (1810). — *Calyptrostegia angustifolia* (R. Br.) C. Meyer, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 74 (1845). — *Banksia angustifolia* (R. Br.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* King George Sound, Western Australia, Dec. 1801, *F.L. Bauer* (BM).

Pimelea angustifolia var. *minor* Meissner in Lehm., Pl. Preiss. 2: 269 (1848). *Type:* "New South Wales" [actually collected in Western Australia], date unknown, *"Frazer"* [presumably *C. Fraser]* (presumed holo: NY).

Pimelea angustifolia var. *major* Meissner in Lehm., Pl. Preiss. 2: 269 (1848). *Type:* south-western Australia, date unknown, *J. Drummond* 287 (iso: LD, MEL, NY).

Pimelea angustifolia var. *drummondii* Meissner in Lehm., Pl. Preiss. 2: 269 (1848). *Type:* south-western Australia, 1843-1844, *J. Drummond* coll. 3, n. 237 (iso: MEL).

Pimelea nervosa Meissner in Lehm., Pl. Preiss. 2: 269-270 (1848). — *Calyptrostegia nervosa* (Meissner) Walp., Annales Botanices Systematicae 3: 324 (1852). — *Banksia nervosa* (Meissner) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* south-western Australia, 1842, *J. Gilbert* (presumed holo: NY).

Pimelea angustifolia var. *calvescens* Meissner in DC., Prodr. 14: 499 (1857). *Type:* Oyster Harbour, King George Sound, Western Australia, 22 Jan. 1818, *A. Cunningham* (NY).

Pimelea tenuis Scott, Bull. Misc. Inform. 116-117 (1915). *Type:* Nangeenan, Western Australia, date unknown, *F. Stoward* 113 (holo: K).

Pimelea tenuis var. *longistyla* Scott, Bull. Misc. Inform. 117 (1915). *Type:* Camp 57 of the Elder Expedition, [c. 30°S, 124°E] Western Australia, 20 Sept. 1891, *R. Helms* (holo: K, n.v., photo in PERTH; iso: MEL).

Shrub, erect, spindly or open, 0.1-1 (possibly rarely 1-1.5) m high, single-stemmed or very rarely multi-stemmed at ground level. *Stems* medium to deep red-brown or sometimes partially yellowish near each inflorescence, becoming medium grey or medium grey-brown to almost black further from apex, glabrous except for axillary hairs. *Leaves* opposite, antrorse, glabrous; petiole 0.2-1 mm long; lamina concolorous, medium green, usually narrowly elliptic to linear, (2-)6-30 x 1-5 mm, flat or adaxially concave, acute or narrowly obtuse. *Peduncle* 2-32 mm long. *Involucral bracts* 4 or very rarely 6, closely surrounding flowers, not becoming reflexed, medium green or very rarely partly to fully reddish, usually ovate, rarely narrowly ovate

or broadly ovate, 4-15 x 2.5-8 mm, glabrous outside, hairy inside at least near centre and base or the outer bracts rarely glabrous inside, not ciliate; hairs appressed or rarely antrorse. *Inflorescence* usually erect or semi-pendulous, rarely pendulous, compact. *Pedicels* usually 0.3-0.5 mm long; hairs usually c. 1.2 mm long. *Flowers* bisexual or female, usually white or cream, sometimes pale pink or yellow, glabrous inside floral tube and sepals; tube (4.5-)6-16 mm long, circumscissile c. 1 mm above ovary. *Proximal portion of floral tube* (below circumscission point) 2-4 x c. 1 mm, rather densely to very densely hairy, dark-coloured but the colour hidden by hairs; hairs all antrorse or the distal ones patent, the longest hairs 1-3.5 mm long, not as fine as those occurring above circumscission point. *Distal portion of floral tube* (above circumscission point) very narrowly cylindric to cylindric, (2.5-)4-12 mm long, c. 1 mm diam. at summit; hairs all antrorse or a small minority patent, very fine, the longest ones 0.5-1 mm long, the shortest ones c. 0.1 mm long. *Sepals* elliptic to ovate, (1.5-)2-3(-4) mm long, with hairs similar to those on distal part of tube or with a few hairs longer, the longest ones up to 2 mm long. *Stamens* shorter or longer than sepals; filament 1-4 mm long; anther 0.6-1.3 x 0.2-0.7 mm; connective narrow to very broad but always at least slightly narrower than anther; slits adaxial to almost lateral after dehiscence, usually semi-lateral, rarely strictly adaxial. *Staminodes:* filament commonly 0.3-0.5 mm long; anther commonly 0.1-0.5 x c. 0.1 mm. *Ovary* glabrous or rarely with apical hairs up to 0.6 mm. *Style* exserted by 1-5 mm. *Seed* not seen. (Figure 31.)

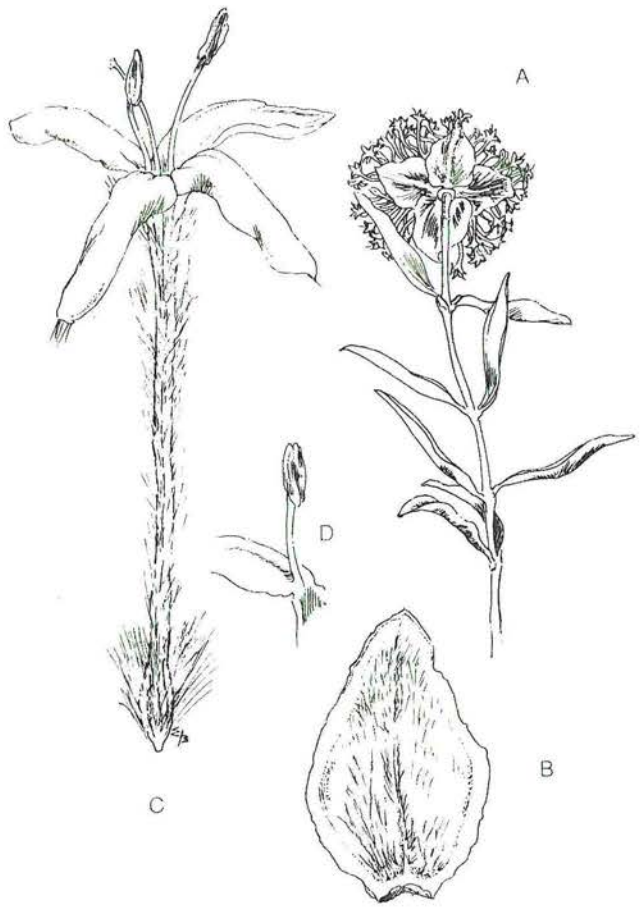

Figure 31. *Pimelea angustifolia*. A- flowering stem; B- inner surface of bract (x 6); C- flower (x 11); D- stamen (x 16). Drawn from fresh material represented by *R.J. Cranfield* 2959 (A) and *N. Cohen* 1011 (B, C, D).

Specimens examined. WESTERN AUSTRALIA (selected from c. 300 seen): W of Moora, *A.M. Ashby* 1286 (AD); 5 mi [8 km] NW of Point Culver, *M.G. Brooker* 3684 (PERTH); Pingelly-Wandering road, *N.T. Burbidge* 7899 (CANB); Oyster Harbour, King George Sound, *A. Cunningham* 22 (MEL); Menzies, date unknown, *L. Diels* (PERTH); c. 13 km Oldfield River estuary, *N.N. Donner* 2998 (AD, PERTH); near foot of Mt Ragged, *H. Eichler* 20409 (CANB, PERTH); near Southern Cross, *A.R. Fairall* 2425 (CANB); No Tree Hill, *A.S. George* 1984 (PERTH); Queen Victoria Rock, *A.S. George* 8030 (PERTH); 11 mi [17.5 km] from Kalbarri on the Northwest Hwy, *C.H. Gittins* 1594 (BRI, NSW, PERTH); 8 km S of Eneabba, *E.A. Griffin* 828 (PERTH); near Cowcowing, *L. Haegi* 1104 (AD, PERTH); near Warangering c. 100 km S of Kalgoorlie, 14 Nov. 1891, *R. Helms* (AD); Mt Hampton, *E.N.S. Jackson* 3403 (AD); 11 km WNW of Northcliffe, 27 Aug. 1983, *G.J. Keighery* (PERTH); 3 km S of Mount Barker, *K.F. Kenneally* 6478 (PERTH); Collie Basin, *J. Koch* 528 (PERTH); Merredin, *M. Koch* 2898 (MEL); Bushmead, *F. Lullfitz* 1817 (PERTH); Howatharra Hill Reserve, *D. McFarlane & N. McFarlane* 1173 (PERTH); 4 mi [6.5 km] NW of Ongerup, *K. Newbey* 62 (PERTH); 2 mi [3 km] E of Yuna, *K. Newbey* 2212 (PERTH); 10 mi [16 km] W of Bremer Bay, *K. Newbey* 2401 (PERTH); 21 km SW of 90 Mile Tank, Frank Hann National Park, *K. Newbey* 6511 (PERTH); Duke of Orleans Bay, *A.E. Orchard* 1317 (AD, PERTH); 11 mi [17.5 km] N of Lake Grace, *S. Paust* 888 (PERTH); 19 mi [30.5 km] S of Morawa, 2 Oct. 1962, *M.E. Phillips* (CBG); Hithergreen, *R.D. Royce* 5754 (PERTH); Glen Forrest, *B.L. Rye* 82013 (PERTH); Katanning, date unknown, *J. Scott* (NSW); 12 mi [19.5 km] NW of Wialki, 4 Oct. 1958, *G.M. Storr* (PERTH); near Bornholm, *A. Strid* 21814 (PERTH); Albany Highway, 9 km NW of Williams, *J. Taylor* 2116 & *P. Ollerenshaw* (CBG); Eucla, 1885, *G.R. Turner* (MEL).

Distribution. (Figure 28.) Extends from Kalbarri National Park (27°54' S, 114°26' E) in the north to the extreme south-west of the state, to Eucla (31°43' S, 128°54' E) in the east and inland to Menzies (29°42' S, 121°02' E). Not recorded for South Australia but possibly extends into that state because it has been recorded very close to the South Australian border at Eucla.

Habitat. Occurs mainly in sand, sometimes in gravelly sand or soil with lateritic rocks, sometimes in sandy clay and then usually in seasonally waterlogged sites. The dominant vegetation consists of shrubs, mallees or sometimes woodland trees.

Flowering period. Mainly August-January.

Affinities. Closest to *Pimelea floribunda* and to the eastern Australian species *P. linifolia.*

Notes. An extremely variable species throughout its geographical range but not readily divisible into infraspecific taxa. Specimens with six bracts are restricted to the northern part of the species range, occurring mainly from Eneabba to Geraldton, while pink-flowered specimens are concentrated in the south in the Albany area. Other relatively unusual characteristics, such as adaxial anther slits, are scattered throughout the species range. In some specimens the hairs below the circumscission point are very dense, as in *P. floribunda,* so that the ovary-portion is obscured from view. Some specimens have much sparser hairs, more like those in *P. sulphurea,* and the ovary-portion is clearly visible through the hairs.

22. **Pimelea floribunda** Meissner in DC., Prodr. 14: 505 (1857). — *Banksia floribunda* (Meissner) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* south-western Australia, 1843-1844, *J. Drummond* coll. 3, n. 214 (iso: LD, MEL, NY).

Shrub, erect, open, 0.25-1 mm high, single-stemmed at ground level. *Stems* yellowish or red-brown near each inflorescence, becoming medium grey-brown further from apex, glabrous except for axillary hairs. *Leaves* opposite, antrorse or patent, tending to all point vertically

when on an oblique to horizontal portion of stem, glabrous; petiole 0.5-1.3 mm long; lamina almost concolorous, medium green or bluish green on adaxial surface, similar but slightly more glaucous on abaxial surface, ovate to elliptic or more often narrowly so, (7-)12-40 x (2-)6-15 mm, rather thick, adaxially concave, acute or narrowly obtuse. *Peduncle* 2-27 mm long. *Involucral bracts* 4 or very rarely 6, sometimes closely subtended by 2 bract-like leaves, laterally overlapping considerably and closely surrounding basal 1/3-1/2 of inflorescence, often strongly recurved in distal 1-8 mm, not becoming reflexed, largely green but red or pink on base, ovate or broadly ovate, 10-28 x 8-20 mm, glabrous outside, appressed-hairy inside but not near margins, not ciliate or only the innermost pair (when 6 bracts present) with some cilia 0.5-1 mm long. *Inflorescence* pendulous, compact. *Flowers* bisexual or rarely female, white or cream above circumscission point, glabrous inside; tube 14-17 mm long in bisexual flowers, c. 11 mm long in female flowers, circumscissile 2-3 mm above ovary. *Proximal portion of floral tube* (below circumscission point) 3-4 x c. 1 mm, densely hairy, dark-coloured but the colour hidden by hairs; hairs mostly antrorse to patent and c. 2 mm long but the uppermost hairs shorter and retrorse, not as fine as hairs above circumscission point. *Distal portion of floral tube* (above circumscission point) 10-12 mm long in bisexual flowers, c. 7 mm long in female flowers, densely covered by very fine retrorse fairs 0.1-0.3 mm long in the proximal (2-)3-4 mm and often also with a few longer antrorse hairs similar to the longer hairs occurring higher on tube, the distal 6-9 mm with short, usually patent, hairs c. 0.2 mm long and longer antrorse hairs, the longest hairs c. 1 mm long. *Sepals* narrowly elliptic, 3.5-5 mm long, with short hairs and a few longer hairs 1.5-2 mm long. *Stamens* longer than (usually greatly exceeding) sepals; filament 4-7 mm long; anther 1.2-1.7 x 0.3-0.4 mm; connective narrower than anther; slits semi-lateral after dehiscence. *Staminodes:* filament 1-3 mm long; anther c. 1 mm long. *Ovary* glabrous. *Style* exserted by 9-10 mm. *Seed* not seen. (Figure 32.)

Figure 32. *Pimelea floribunda*. A- flowering stem; B- outer surface of bract (x 2); C- flower (x 5); D- stamen (x 10). Drawn from fresh cultivated material represented by *R.J. Cranfield* 4926.

Specimens examined. WESTERN AUSTRALIA (selected from over 45 seen): Moora, *A.M. Ashby* 74 (AD, PERTH); near Geraldton, *A.M. Ashby* 1576 (AD); E of Badgingarra, *A.M. Ashby* 1924 (AD, PERTH); 19 mi [30.5 km] N of Geraldton, *N.T. Burbidge* 2035 (CANB); Hill River, *C.A. Gardner* 12283 (PERTH); Wanneroo, *A.S. George* 2629 (PERTH); Just N of Lake Indoon, *E.A. Griffin* 929 (PERTH); near Coomallo Creek, *R.J. Hnatiuk* 770859 (PERTH); Yanchep National Park, *A.M. James* 288 (PERTH); 8 mi [13 km] W of Northampton, *R. Melville* 4175 & *J. Calaby* (MEL, PERTH); 1 mi [1.5 km] W of Gingin, *K. Newbey* 1673 (PERTH); 6.5 mi [10.5 km] S of Dongara, *M.E. Phillips* 681406 (CBG); 32 mi [51 km] S of Geraldton, *R.D. Royce* 388 (PERTH).

Distribution. (Figure 30.) Extends from near Northampton (28°22' S, 114°33' E) south to Wanneroo (31°45' S, 115°48' E).

Habitat. Occurs in sand over limestone along the coast and in deep sand or on lateritic breakaways further inland.

Flowering period. July-October.

Affinities. Closest to *Pimelea angustifolia.*

Notes. The name *Pimelea macrocephala* Hook., published five years before *P. floribunda,* probably applies to the same species. However, there is some doubt about the correct application of this name, as noted in more detail under *P. drummondii.*

23. **Pimelea sulphurea** Meissner, Bot. Zeitung (Berlin) 6: 396 (1848). — *Calyptrostegia sulphurea* (Meissner) Walp., Annales Botanices Systematicae 3: 325 (1852). — *Banksia sulphurea* (Meissner) Kuntze (as *sulfurea*), Revis. Gen. Pl. 2: 583 (1891). *Type:* near "Pine-Apple" [in Maylands], Perth, Western Australia, 8 June 1839, *L. Preiss* 1278 (lecto here designated: LD; isolecto: MEL, NY); south-western Australia, date unknown, *J. Drummond* 549 (isosyn: MEL).

[Pimelea flava auct. non R. Br.; Meissner in Lehm., Pl. Preiss. 1: 605 (1845).]

Shrub, erect, spindly or open, 0.15-0.6 m high, often multi-stemmed at ground level, regenerating from an elongate woody underground stock. *Stems* dark red-brown near each inflorescence or yellowish first then red-brown, becoming medium grey or grey-brown further from apex, glabrous except for axillary hairs. *Leaves* opposite, antrorse or patent, sessile to subsessile, the petiole up to 0.4 mm long; lamina concolorous, medium green or bluish green, narrowly elliptic to circular, 2-16 x 1.5-9 mm, flat or adaxially concave, acute or obtuse. *Peduncle* 1-5 mm long. *Involucral bracts* in 3-5 pairs, closely surrounding flowers, not becoming reflexed, the same colour as leaves or sometimes more yellowish, narrowly elliptic to circular, 4-15 x 3-10 mm; outermost bracts glabrous outside, usually appressed-hairy inside, not ciliate; inner 2 or 4 bracts glabrous outside or with a few hairs toward apex, appressed-hairy inside, densely ciliate around apex, the longest cilia 0.5-1 mm long. *Inflorescence* pendulous, compact. *Pedicels* 0.2-0.6 mm long; hairs 1-2 mm long. *Flowers* bisexual or rarely female, yellow, glabrous inside floral tube and sepals; tube 6.5-17 mm long, circumscissile 0.5-3 mm above ovary-portion. *Ovary-portion of floral tube* 1.5-3 x c. 1 mm; hairs appressed or antrorse, 1-2 mm long, not as fine as those occurring above circumscission point. *Style-portion of floral tube* narrowly or very narrowly cylindric, 4-14 mm long, 1-1.3 mm diam at summit, with hairs similar to those on ovary-portion occurring below circumscission point; indumentum above circumscission point a mixture of antrorse or rarely patent hairs 0.6-1.5 mm long and shorter patent hairs 0.1-0.3 mm long, the hairs often somewhat tangled. *Sepals* narrowly elliptic or elliptic, 2-5 mm long, with hairs similar to those on distal part of floral tube. *Stamens*

shorter or longer than sepals; filament 1.5-4 mm long; anther 0.6-1.4 x 0.2-0.4 mm; connective rather broad but narrower than anther; slits semi-lateral after dehiscence. *Staminodes:* filament 0.2-1.5 mm long; anther 0.2-0.5 x c. 0.1 mm. *Ovary* with a terminal tuft of hairs; longest hairs 0.4-0.8 mm long. *Style* exserted by 2.5-9 mm. *Seed* not seen. (Figure 33.)

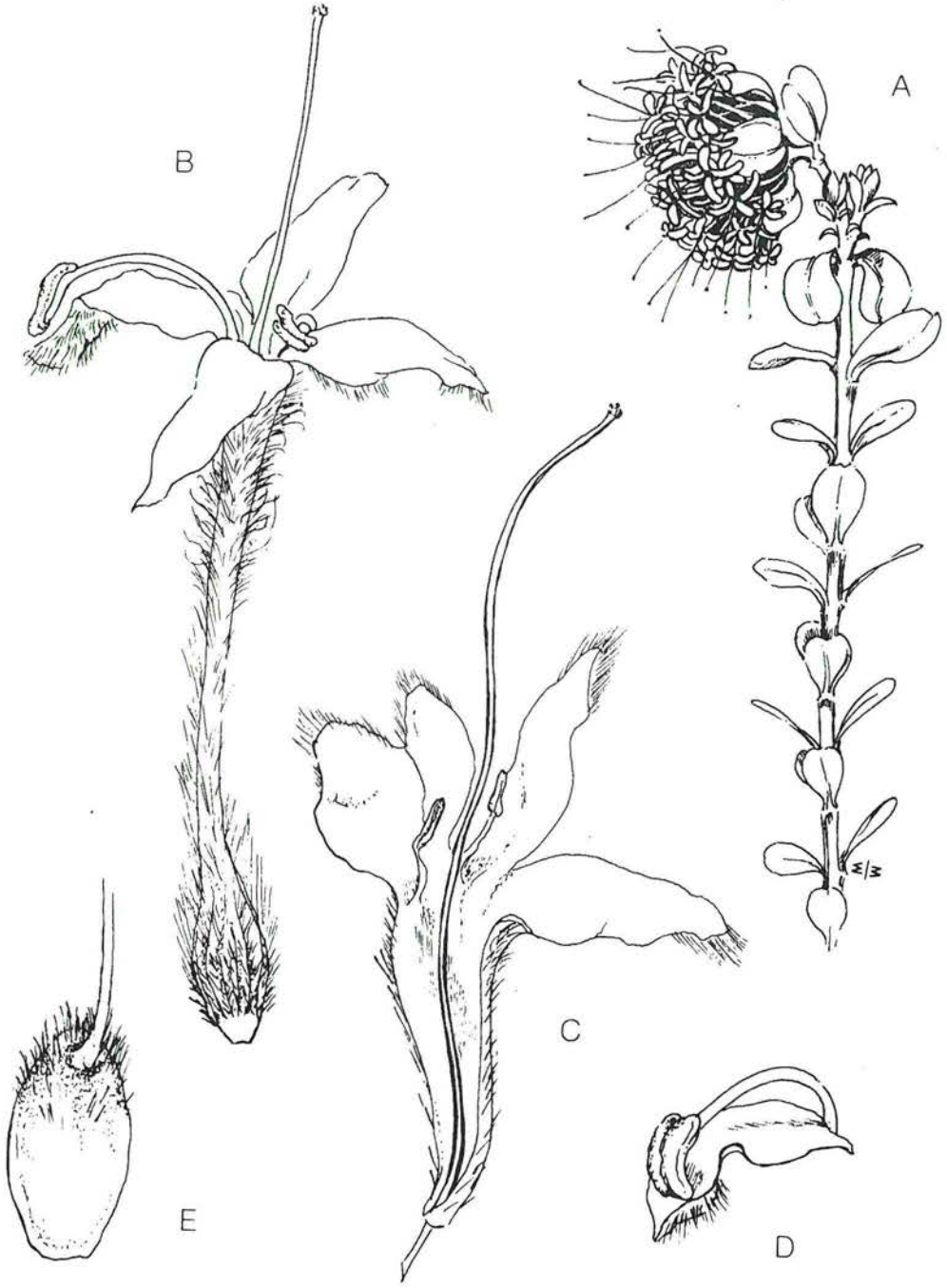

Figure 33. *Pimelea sulphurea*. A- flowering stem of female plant; B- bisexual flower (x 10); C- opened upper part of female flower (x 8); D- old stamen (x 10); E- ovary (x 20). Drawn from fresh material represented by *N. Cohen* 1005 (A, C, E) and *N. Cohen* 1006 (B, D).

Specimens examined. WESTERN AUSTRALIA (selected from over 95 seen): near Tambellup, *A.M. Ashby* 2723 (AD, PERTH); Mt Lesueur, *J.S. Beard* 7824 (NSW, PERTH); Wubin, *W.E. Blackall* 3793 (PERTH); between Wagin and Dumbleyung, *N.T. Burbidge* 5603 (CANB); 4.5 mi [7 km] from Gingin toward Bindoon, *E.M. Canning* 683566 (CBG); Kings Park, *I. Common* 429 (CANB); 7 km S of Eneabba, *E.A. Griffin* 964 (PERTH); NE of Lake Pinjar, *J. Havel* 92 (PERTH); 17 km due NE of Brookton, *R.J. Hnatiuk* 790176 (PERTH); 80 km WNW of Kumarl, *T.B. Muir* 4372 (MEL); N of Point Anne, Fitzgerald River National Park, *R.D. Royce* 9129 (PERTH); Bruce Rock, *F. Stoward* 729 (BRI); 0.5 km E of Harrismith, *J. Taylor* 893, *M.D. Crisp & R. Jackson* (CBG, PERTH); c. 80 km W of Daniell, *P. Wilson* 3209 (AD).

Distribution. (Figure 35.) Extends from near Eneabba (29°43' S, 115°14' E) south-east to Fitzgerald River National Park (c. 34°05' S, 119°35' E) and inland to near Southern Cross (c. 31°16' S, 119°28' E).

Habitat. Usually occurs in sand, often with gravel or with a lateritic sheet below the sand, in woodlands or shrublands.

Flowering period. July-November.

Affinities. Probably closest to *Pimelea angustifolia.*

Notes. Specimens occurring well inland tend to have smaller leaves, bracts and flowers than specimens from more humid areas closer to the coast.

24. **Pimelea pendens** Rye, sp. nov. (Figure 34.)

Affinis *P. aeruginosae* F. Muell. sed differt foliis viridibus, floribus pallide viridibus, sepalis longioribus et ovario minus piloso.

Typus: Coolingup Rd, 3.6 km SW of Howick Rd, E of Esperance, Western Australia, 33°33' S, 122°31' E, 13 Aug. 1983, *N. Cohen* 1019A (holo: PERTH; iso: CANB, K, MEL, NSW).

Related to *P. aeruginosa* F. Muell. but differs in the green colour of the leaves, pale green flowers, longer sepals and less hairy ovary.

Shrub, erect, spindly, 0.1-1 m high, single-stemmed at ground level. *Stems* red-brown near each inflorescence, becoming medium grey-brown further from apex, glabrous except for axillary hairs. *Leaves* opposite, patent to antrorse, sessile, concolorous, medium green or sometimes yellowish green, ovate to narrowly elliptic, 6-18 x 3-8 mm, glabrous, acute to obtuse. *Peduncle* 1-5 mm long. *Involucral bracts* in (1)2-4 pairs, closely surrounding flowers, not becoming reflexed, hiding the flowers laterally, pale to medium green or yellow-green and sometimes partially reddish, broadly elliptic or broadest slightly below middle, 14-25 x 12-20 mm, glabrous. *Inflorescence* pendulous, compact. *Pedicels* up to 2 mm long; hairs 2-3 mm long. *Flowers* bisexual or rarely female, pale green, glabrous; tube 9-14 mm long, circumscissile c. 1 mm above ovary-portion. *Ovary-portion of floral tube* 3-3.5 x c. 1 mm. *Style-portion of floral tube* narrowly cylindric and expanding gradually to summit, 6-10.5 mm long, 1-1.5 mm diam. at summit. *Sepals* narrowly ovate to ovate, 3.5-4.5 mm long. *Stamens* shortly exceeding sepals; filament 3-4 mm long; anther 1.25-1.5 x 0.25-0.5 mm; connective much narrower than anther; slits semi-lateral after dehiscence. *Ovary* glabrous or sometimes sparsely hairy in basal half; hairs patent, up to 0.5 mm long. *Style* exserted by 3-5 mm. *Seed* c. 5 x 1.5 mm, longitudinally patterned with slightly raised bumps.

Figure 34. *Pimelea pendens*. A- flowering stem; B- flower (x 10); C- stamen (x 14); D- ovary (x 14). Drawn from fresh material represented by the type collection, *N. Cohen* 1019.

Specimens examined. WESTERN AUSTRALIA: Howick Hill, 20 Sept. 1968, *D.G. Austin* (AD); Lucky Bay, *E.M. Bennett* 897B (PERTH); 0.5 km E of Clyde Hill, *M.A. Burgman* 1197 & *S. McNee* (PERTH); Mt. Ney, *M.A. Clements* 1790 (CANB); type locality, *N. Cohen* 1019B (PERTH); 39.5 km NE of Gibson, *N. Cohen* 1021, 1021a (PERTH); c. 3 km NE of Howick Hill, *H. Eichler* 19866 (AD, PERTH); Mt Arid, *A.S. George* 14307 (PERTH); c. 25 mi [40 km] E of Esperance, *M.E. Phillips* 3197 (CANB); Howick Rd., SW of Mt Ney,

B.L. Rye 82029 (PERTH); Coolinup Rd., 3.6 km SW of Howick Rd., *B.L. Rye* 82031 (PERTH); near Wittenoom Hills, *V. Scarth-Johnson* 869 (BRI); Mississipi Hill, *A.S. Weston* 6776 (PERTH).

Distribution. (Figure 35.) Extends from near Mt Ney (33°27' S, 122°29' E) and Clyde Hill (33°22' S, 122°59' E) to the south coast and along the coast from Frenchman Peak (33°58' S, 122°10' E) east to Mt Arid (33°59' S, 123°12' E).

Habitat. Recorded on granitic scree slopes, also in brown or grey sandy clay on cleared road verges backed by mallee woodlands.

Flowering period. May-August.

Derivation of name. Pendens (L.) — hanging down, referring to the pendulous inflorescences.

Affinities. Closest to *Pimelea aeruginosa* and also similar to *P. cracens. Pimelea pendens* can be readily distinguished from *P. cracens* by its complete lack of hairs on the outside of the flowers. Apart from the differences given in the diagnosis, *P. pendens* differs from *P. aeruginosa* in the colour of the young stems and bracts and in the pattern on the seeds. Some specimens of *P. aeruginosa* have partially hairy sepals but the sepals are always completely glabrous in *P. pendens.*

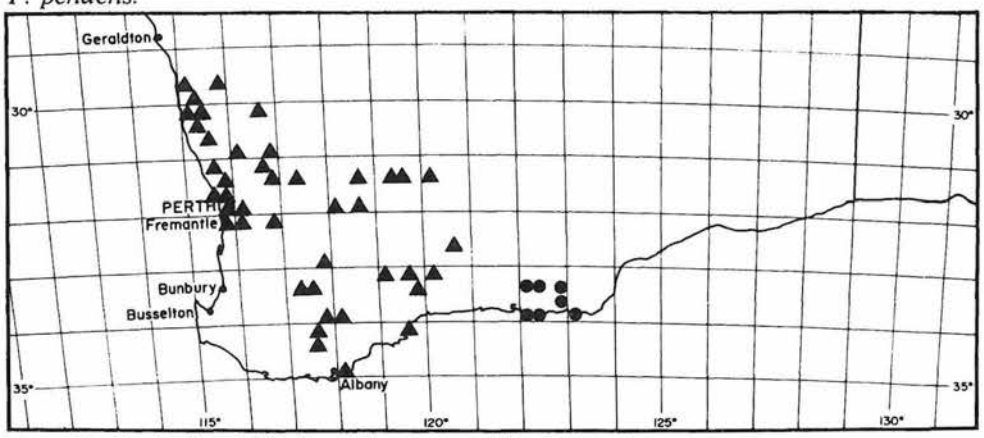

Figure 35. Distribution of *Pimelea sulphurea* ▲, and *P. pendens* ●.

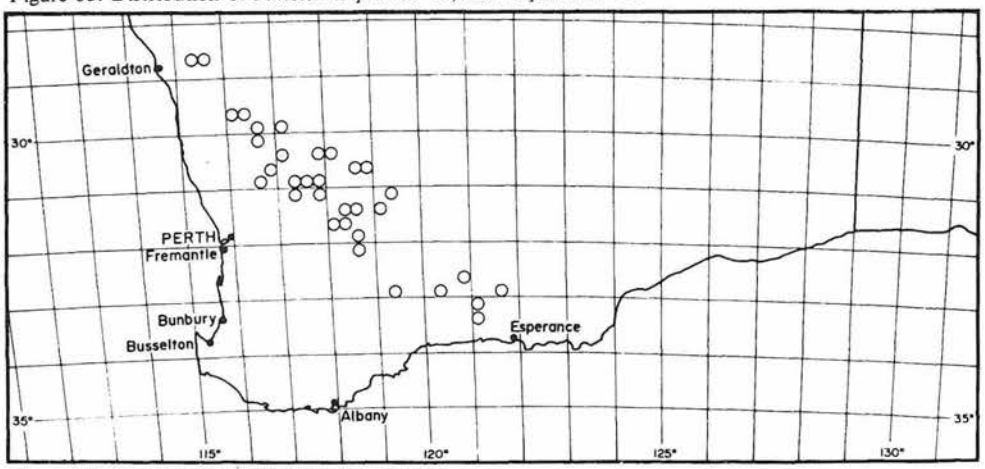

Figure 36. Distribution of *Pimelea aeruginosa.*

25. **Pimelea aeruginosa** F. Muell., Fragm. 7: 2 (1869). — *Pimelea sylvestris* var. *aeruginosa* (F. Muell.) Benth., Fl. Austral. 6: 11-12 (1873). *Type:* south-western Australia, date unknown, *J. Drummond* (holo: MEL).

Shrub, erect, spindly, 0.2-1.5 m high, single-stemmed at ground level. *Stems* yellow-green near each inflorescence, becoming red-brown then grey further from apex, glabrous except for axillary hairs. *Leaves* opposite, patent or antrorse, sessile (but narrowly tapered at base) or with a petiole up to 1 mm long, glabrous; lamina concolorous, bluish to greyish green or sometimes yellowish, narrowly ovate to narrowly obovate, 7-22 x 2.5-7.5 mm, rather thick, adaxially concave, obtuse or nearly acute. *Peduncle* 1.5 mm long. *Involucral bracts* usually in 3-6 pairs, closely surrounding flowers, not becoming reflexed, broadly elliptic to almost circular, 11-25 x 7-17 mm, glabrous on both surfaces; outer bracts not ciliate; inner bracts yellow or yellowish, sometimes with a few fine cilia c. 1 m long around apex or lower on margins. *Inflorescence* pendulous, compact. *Pedicels* 0.5-1.5 mm long; hairs up to 2.5 mm long. *Flowers* bisexual or rarely female, dark-coloured below the distinct circumscission point, yellow above; tube 11-15 mm long, circumscissile 0.7-1.2 mm above ovary-portion, glabrous. *Ovary-portion of floral tube* 3-4 x 1-1.5 mm. *Style-portion of floral tube* narrowly cylindric but enlarging gradually to summit, 8-11 mm long, c. 1 mm diam. at summit. *Sepals* elliptic-ovate or narrowly so to elliptic, 3-4 mm long, glabrous outside or with a few hairs along midrib, glabrous inside; hairs up to 1.25 mm long, very fine. *Stamens* shorter than to exceeding sepals; filament 1.5-4 mm long; anther 1-1.5 x 0.3-0.6 mm; connective much narrower than anther; slits semi-lateral to lateral after dehiscence. *Ovary* hairy throughout but sometimes only very sparsely so; hairs appressed to antrorse, 0.3-0.5 mm long, very fine. *Style* exserted by 4-7 mm. *Seed* c. 4.5 x 1.5 mm, with longitudinal furrows. (Figure 37.)

Specimens examined. WESTERN AUSTRALIA (selected from over 80 seen): between Perenjori and Carnamah, *J.C. Anway* 533 (PERTH); 3 mi [5 km] W of Kulja, *T.E.H. Aplin* 536 (PERTH); 3 mi [5 km] S of Wubin, *T.E.H. Aplin* 558 (PERTH); Tammin, *A.M. Ashby* 972 (AD); Muntagin, *E.T. Bailey* 639 (PERTH); 11 mi [18 km] E of Narembeen, *J.S. Beard* 5908 (CANB); near Walgoorlan, *W.E. Blackall* 4002 (PERTH); 10 mi [16 km] N of Trayning, *M.I.H. Brooker* 1891 (PERTH); 13 km E of Koorda, *M.D. Crisp* 6539 (CBG); S Yanneymooning, *P. de Rebeira* 171 (PERTH); Wilroy *A.R. Fairall* 1483 (PERTH); 5 mi [8 km] E of Burracoppin, *R. Filson* 212 (MEL); Wyalkatchem, *C.A. Gardner* 179 (MEL, PERTH); 39 mi [63 km] E of Pingaring, *A.S. George* 9340 (PERTH); Ballidu, *E.H. Ising* 93 (AD); Cowcowing, *M. Koch* 1009 (MEL, PERTH); Merredin, *M. Koch* 2771 (MEL); 20 km W of Tandejin, *R.H. Kuchel* 2063 (AD, CANB); 39 mi [63 km] E of Lake King on Norseman road, *F. Lullfitz* 5027 (PERTH); Frank Hann National Park, *D. Monk* 398 (PERTH); near Gabbin, *B. Rosier* 82 (PERTH); 11 mi [18 km] N of Jibberding, *R.A. Saffrey* 861 (PERTH); 15 km N of Trayning, *P.S. Valentine* T44 (PERTH); E of Caron, *F.W. Went* 98 (PERTH); 1 mi [1.5 km] E of Wyalkatchem, *E. Wittwer* 1225 (PERTH).

Distribution. (Figure 36.) Extends from near Mullewa (28°36' S, 115°24' E) south-east to north of Stokes Inlet (c. 33°06' S, 121°10' E).

Habitat. Over most of its range the species occurs in sand or sandy clay, often mixed with gravel or overlying laterite, and the soil colour is commonly yellow. In the south-east, the soil is sometimes pale brown and overlying clay. The vegetation is often mallee-dominated.

Flowering period. Mainly June-October.

Affinities. Closest to *Pimelea pendens* and *P. cracens*. See notes under those species.

Notes. The specimens with hairs on the outside of the sepals are all from the south-eastern part of the species range.

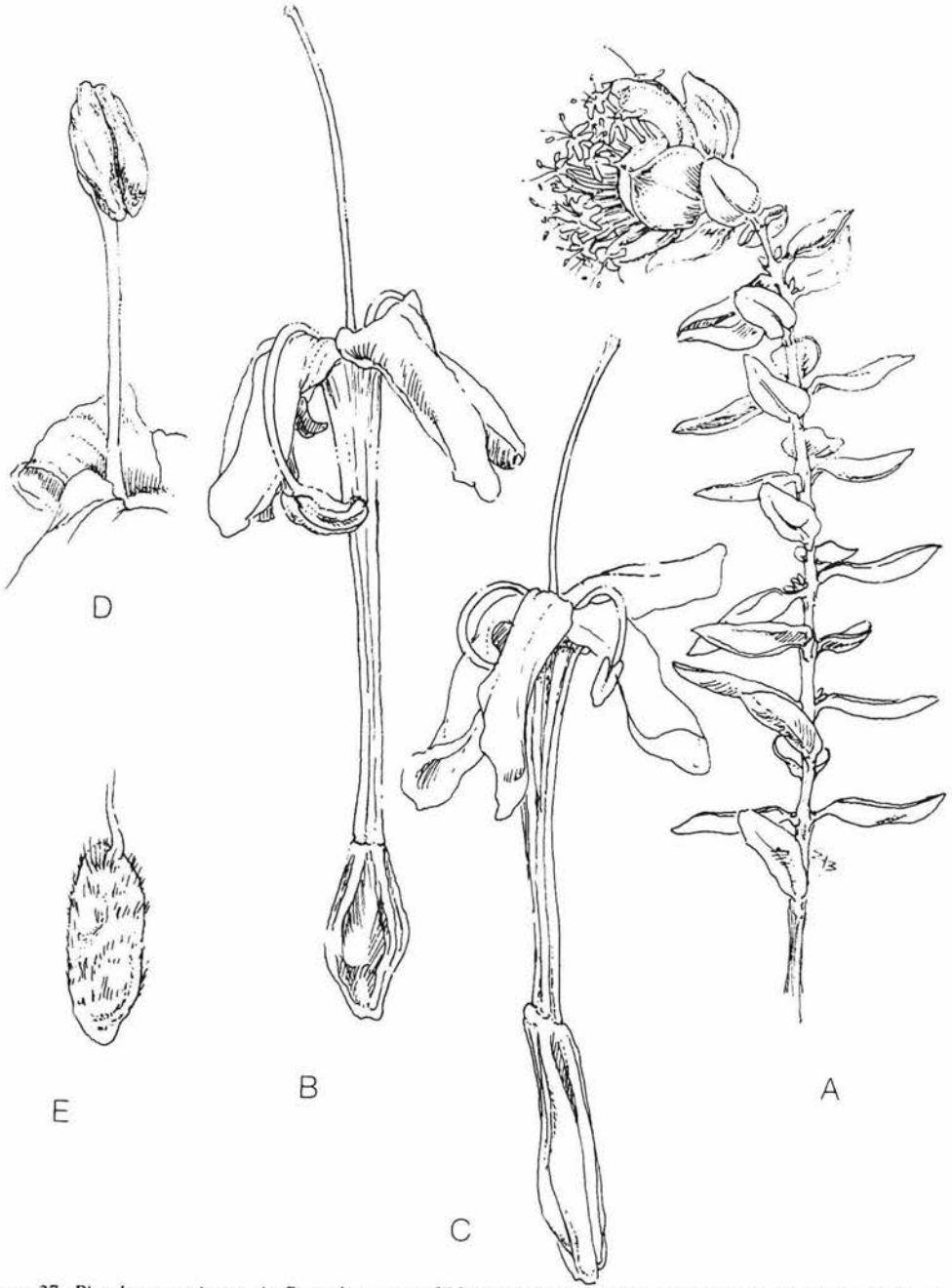

Figure 37. *Pimelea aeruginosa*. A- flowering stem of bisexual plant; B- bisexual flower (x 8); C- female flower (x 8); D- stamen (x 15); E- ovary (x 14). Drawn from fresh material represented by *N. Cohen* 1024 (A, B, D, E) and *N. Cohen* 1024a (C).

26. **Pimelea cracens** Rye, sp. nov. (Figure 38.)

Affinis *P. aeruginosae* F. Muell. sed differt foliis acutis, tubo florali plerumque piloso, proportione ovariali breviore et sepalis magis pilosis.

Typus: Dempster Rd, 8.3 km NE of Norwood Rd, NE of Esperance, Western Australia, 33°21' S, 122°05' E, 13 Aug. 1983. *N. Cohen* 1023 (holo: PERTH; iso: CANB, K, MEL, NSW).

Related to *P. aeruginosa* F. Muell. but differs in the acute leaves, the usually hairy floral tube with a shorter ovary-portion, and the more hairy sepals.

Shrub, erect, spindly, 0.4-1.5 m high, single - or sometimes multi-stemmed at ground level. *Stems* yellow to pale green near each inflorescence, becoming reddish then medium grey-brown further from apex, glabrous except for axillary hairs. *Leaves* opposite, usually patent or antrorse, sometimes somewhat reflexed, glabrous; petiole 0.3-1.3 mm long; lamina concolorous, yellowish or medium green to deep bluish green, narrowly elliptic to ovate or nearly so, 6-22 x 2-6 mm or rarely less in the smallest leaves of a branch, thinner than in *P. aeruginosa,* flat or adaxially concave, acute. *Peduncle* 1-4 mm long. *Involucral bracts* usually 6 or 8, rarely 10, paired, closely surrounding flowers, not becoming reflexed, yellowish or pale green, sometimes with reddish portions or the outer bracts sometimes fully or partly the same colour as leaves, elliptic, 12-28 x 6-14 mm, glabrous or sometimes with a few appressed hairs inside at base or along middle. *Inflorescence* pendulous, compact. *Pedicels* usually c. 1 mm long; hairs 1-2.5 mm long. *Flowers* bisexual or rarely female, cream or creamy green to pale yellow, glabrous inside floral tube and sepals; tube 7.5-12 mm long, circumscissile 0.5-2 mm above ovary-portion. *Ovary-portion of floral tube* 2-2.5 x c. 0.9 mm, hairy or glabrous; hairs antrorse, 1-3 mm long, very fine, the longest ones exceeding those on style-portion. *Style-portion of floral tube* very narrowly cylindric, 7-9.5 mm long in bisexual flowers, 5-6 mm long in female flowers, 0.7-1.2 mm diam. at summit, hairy or glabrous; indumentum (when present) of very fine, widely antrorse to patent hairs, commonly a mixture of long and short hairs in the range 0.3-2.5 mm long, sometimes consisting of a few long hairs restricted to distal part or sometimes the hairs widespread but all short. *Sepals* elliptic or nearly so, 2.5-4.5 mm long, hairy outside; hairs 0.3-2.5 mm long. *Stamens* slightly or definitely longer than sepals; filament 2-4 mm long; anther c. 1 x 0.3 mm; connective narrower than anther; slits semi-lateral after dehiscence. *Staminodes:* filament c. 0.2 mm long; anther c. 0.35 mm long. *Ovary* hairy throughout; hairs appressed, very fine, the longest ones 0.3-1 mm long. *Style* exserted by 4-6 mm. *Seed* c. 4 x 1.7 mm, with faint longitudinal markings.

Distribution. (Figure 42.) Extends from the Donnelly River east to near Israelite Bay and inland north to Kumarl.

Flowering period. July-November and rarely December.

Derivation of name. Cracens (L.) — graceful, slender, referring to the habit.

Affinities. Closest to *Pimelea aeruginosa* overall. In vegetative morphology more similar to *P. tinctoria* except in the lack of cilia on the involucral bracts. The leaves of both *P. cracens* and *P. tinctoria* are not as thick as those of *P. aeruginosa.*

Notes. The two subspecies recognised are allopatric. They appear to be distinguished only by the presence/absence and type of indumentum on the floral tube. However, they show no intergradation and are regarded here as being just distinct enough to be recognised as subspecies rather than as varieties.

Key to Subspecies

1. Floral tube completely glabrous or with a few hairs 1-2 mm long near summit.....26a. subsp. *glabra*
1. Floral tube hairy throughout, the shortest hairs of the style-portion 0.3-0.5 mm long.....26b. subsp *cracens*

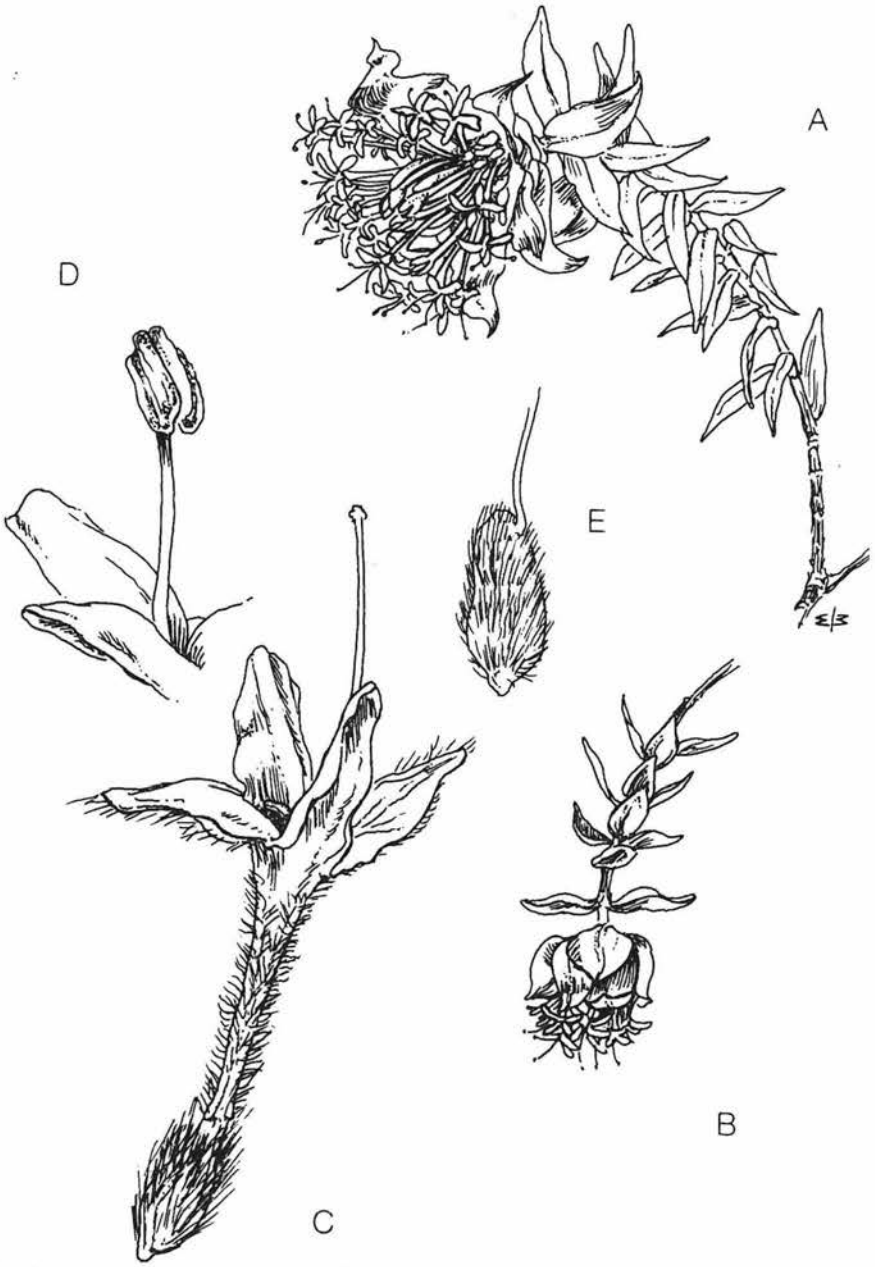

Figure 38. *Pimelea cracens* subsp. *cracens*. A- flowering stem of bisexual plant; B- flowering stem of female plant; C- female flower (x 8); D- stamen (x 14); E- ovary (x 14). Drawn from fresh material represented by *N. Cohen* 1023 (A, D, E) and *K. Newbey* 9843 (B, C).

26a. subsp. **glabra** Rye, subsp. nov.

Differt a *P. cracente* Rye subsp. *cracente* floribus glabris vel subglabris.

Typus: Palgarup Swamp, c. 6 km N of Manjimup, Western Australia, *J.R. Wheeler* 2069 (holo: PERTH; iso: CANB, K, MEL, NSW).

Differs from *P. cracens* Rye subsp. *cracens* in the glabrous or almost glabrous flowers.

Floral tube completely glabrous or with a few hairs 1-2 mm long in distal half of style-portion.

Specimens examined. WESTERN AUSTRALIA: Donnelly River plains, W of Manjimup, *A.M. Ashby* 504 (PERTH); Muir Rd, E of Lake Muir, *W.R. Barker* 2347 (AD); Mersea Lake, Wilgarup, Nov. 1962, *W.A. Loneragan* (PERTH).

Distribution. (Figure 42) Extends from the Donnelly River (c. 34°13' S, 115°55' E) east to Lake Muir (34°26' S, 116°25' E).

Habitat: Apparently associated with wetlands but no habitat details provided on specimen sheets.

Flowering period. August-November.

Derivation of name. Glaber (L.) — hairless, referring to floral tube.

26b. subsp. **cracens**

Floral tube hairy throughout; ovary-portion with fine antrorse hairs 1-3 mm long; style-portion with a mixture of short and long hairs or with only short hairs, the shortest hairs 0.3-0.5 mm long and longest hairs up to 2.5 mm long. (Figure 38.)

Specimens examined. WESTERN AUSTRALIA (selected from over 90 seen): near Hamersley River, Oct. 1903, *C. Andrews* (PERTH); Lake King, *J.S. Beard* 2185 (PERTH); Pingrup, *W.E. Blackall* 3025 (PERTH); Circle Valley, *A.J. Cough* 10 (PERTH); Buyi Billanak Homestead, SE of Condingup Peak, *N.N. Donner* 2662 (AD, CANB, PERTH); c. 58 km N of mouth of Oldfield River, *H. Eichler* 20379 (AD, CANB, PERTH); near Truslove, *C.A. Gardner* 14190 (PERTH); c. 80 km ENE of Lake King towards Norseman, *L. Haegi* 997 (AD, PERTH); Kumarl, *L.A. Horbury* 69 (PERTH); Bremer Bay area, *A. Kessell* 996 (PERTH); Salmon Gums, *R.H. Kuchel* 1731 (AD); W end of Lake King, *F. Lullfitz* 5538 (PERTH); c. 12 km N of Israelite Bay, *E.C. Nelson* (PERTH); Frank Hann National Park, *K. Newbey* 5564 (PERTH); c. 3 km NE of Howick Hill, *A.E. Orchard* 1131 (AD, PERTH); 25 mi [40 km] W of Ravensthorpe, *S. Paust* 711 (PERTH); 35 km E of Gnowangerup, *B.L. Rye* 82015 (PERTH); 6.5 km W of Lake Biddy, *R.A. Saffrey* 593 (PERTH); Frankland River, Nov. 1932. *H. Steedman* (PERTH); 10.5 km NNW of Ongerup, *M.D. Tindale* 3892 (CANB, PERTH); Mt Madden, *P.G. Wilson* 6828 (PERTH); 6 km from Borden towards Amelup, *J.W. Wrigley* 684851 (PERTH).

Distribution (Figure 42.) Extends from near Mount Barker (c. 34°38' S, 117°40' E) east to near Israelite Bay (c. 33°37' S, 123°52' E) and inland as far north as Kumarl (32°47' S, 121°33' E).

Habitat. Occurs in sandy clay or rarely sand, often in shrublands dominated by scattered mallees.

Flowering period. July-November and rarely December.

27. **Pimelea tinctoria** Meissner in Lehm., Pl. Preiss. 1: 603 (1845) — *Calyptrostegia tinctoria* (Meissner) Endl., Gen. Pl. Suppl. 4: 61 (1848). — *Pimelea suaveolens* var. *tinctoria* (Meissner) Benth., Fl. Austral. 6: 14-15 (1873). — *Banksia tinctoria* (Meissner) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* "Mt Wuljenup" [Willyung Hill], Western Australia, 20 Oct. 1840, *L. Preiss* 1280 (presumed holo: LD; iso: MEL).

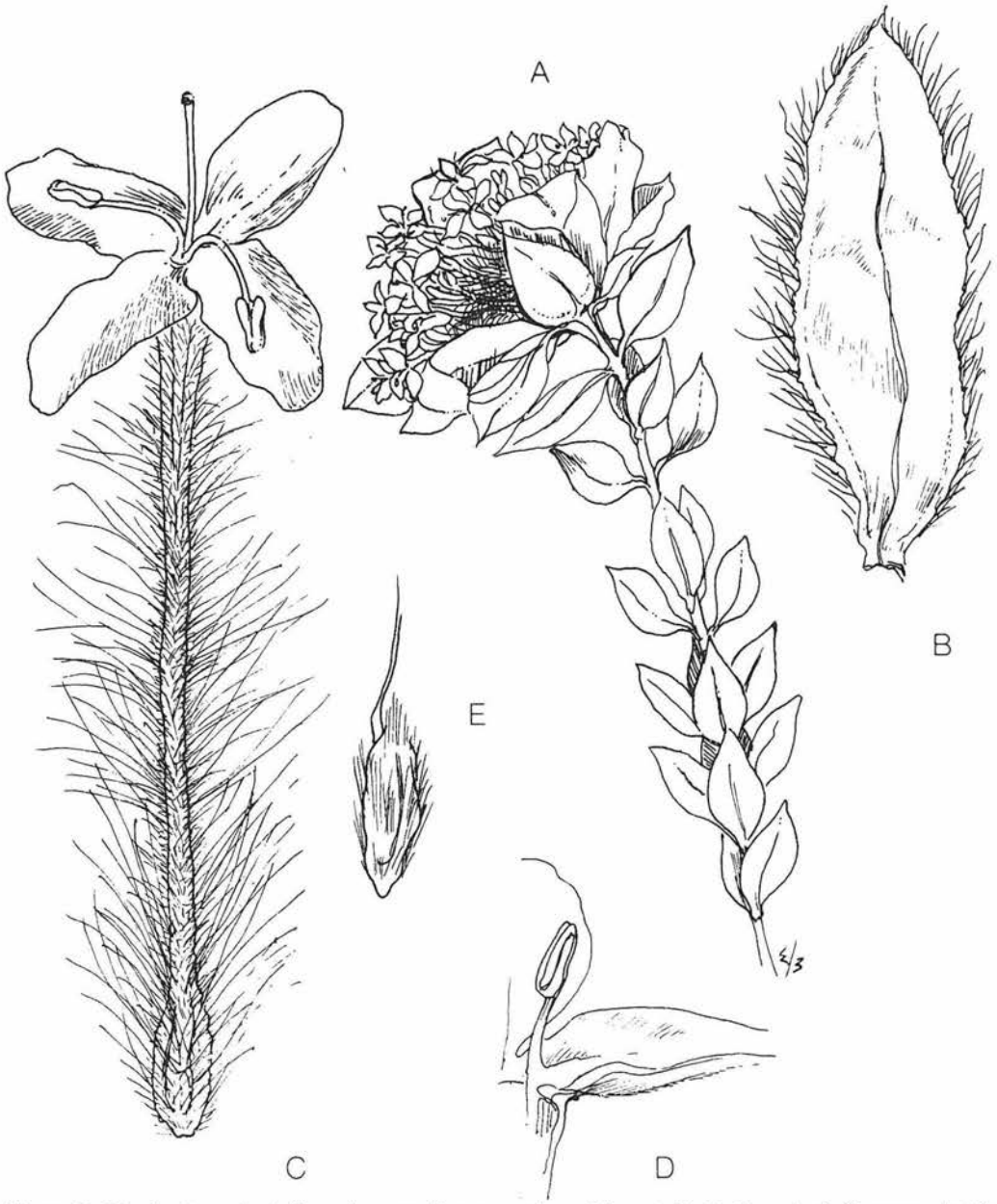

Figure 39. *Pimelea tinctoria.* A- flowering stem; B- outer surface of bract (x 3); C- flower (x 6); D- stamen (x 10); E- ovary (x 12). Drawn from *A.M. Ashby* 1950 (A, B) and *B.T. Goadby* 2093 (C, D, E).

Shrub, erect, spindly, usually 0.5-1 m high, single-stemmed at ground level. *Stems* red-brown or dark bluish near each inflorescence, becoming grey further from apex, glabrous except for axillary hairs. *Leaves* opposite, antrorse, glabrous; petiole 1-2 mm long; lamina concolorous, bluish green or sometimes yellowish, elliptic or nearly so, 9-21 x 4-10 mm, flat or with the adaxial surface slightly concave, acute or narrowly obtuse. *Peduncle* 1-3 mm long. *Involucral bracts* usually in 4-7 pairs, not becoming reflexed, yellow, often with green patches, ovate-elliptic to narrowly elliptic, 18-27 x 6-17 mm, closely surrounding flowers, densely ciliate, otherwise glabrous or with a few appressed hairs inside along midrib; longest cilia 2.5-3.5

mm long. *Inflorescence* pendulous, compact. *Pedicels* 0.5-2 mm long; hairs 1-2 mm long. *Flowers* bisexual, apparently dark red-brown below the circumscission point, yellow or yellowish green above, glabrous inside floral tube and sepals; tube 17.5-22 mm long, circumscissile 1-2 mm above ovary-portion. *Ovary-portion of floral tube* 2.5-3 x 1-1.5 mm, covered by long hairs and more numerous small hairs; long hairs antrorse to patent, 2-4 mm long, usually rather coarse; short hairs commonly 0.1-0.3 mm long. *Style-portion of floral tube* narrowly cylindric but expanding gradually to summit, 14-19 mm long, 1-1.5 mm diam. at summit, with a moderately dense mixture of long and short hairs; long hairs patent, 3-5 mm long, finer than those on ovary-portion; short hairs patent, mostly 0.1-0.3 mm long. *Sepals* elliptic, 3.5-5.5 mm long, sparsely hairy; indumentum mainly of small hairs, with a few long hairs similar to those on the floral tube. *Stamens* shorter than sepals; filament 1.5-4 mm long; anther 1-1.5 x 0.5-1 mm; connective much narrower than anther; slits semi-lateral after dehiscence. *Ovary* rather densely hairy; hairs appressed, 0.2-0.4 mm long, fine. *Style* exserted by 3-4 mm. Mature *seed* not seen. (Figure 39.)

Specimens examined. WESTERN AUSTRALIA (selected from over 40 seen): Mt Manypeaks, *A.M. Ashby* 1950 (AD, PERTH); between Mount Barker and Albany, 13 Oct, 1968, *E.M. Canning* (CBG); near Denmark, *A.B. Cashmore* 27 (PERTH); 6 mi [9.5 km] N of Cape Riche, *C.A. Gardner* 2179 (PERTH); King George Sound, *B.T. Goadby* 38 (PERTH); South Stirlings, *F. Lullfitz* 3458 (PERTH); 6 mi [9.5 km] S of Narrikup, *R. Melville* 4400 & *R.D. Royce* (MEL); Toolbrunup, Stirling Range, *T.B. Muir* 3937 (MEL); 65 mi [104 km] from Albany towards Jerramungup, *S. Paust* 543 (PERTH); Stewart Road, 18.9 km from Vasse Hwy, *J.R. Wheeler* 2111 (PERTH), 65 km NE of Albany towards Jerramungup, *D.J.E. Whibley* 5240 (AD); Chester Pass, Stirling Range, 13 Oct. 1961, *J.H. Willis* (MEL); Millbrook Rd, N of Albany, *E. Wittwer* 271 (PERTH).

Distribution. (Figure 43.) Extends from near Denmark (34°57' S, 117°21' E) east to near Cape Riche (34°35' S, 118°43' E) and inland to the Stirling Range (c. 34°50' S, 118°28' E), with a disjunct occurrence south-west of Nannup (c. 34°12' S, 115°36' E).

Habitat. Recorded in sand, sometimes with gravel, in low shrublands or in clearings.

Flowering period. August-October.

Affinities. Most similar to *Pimelea suaveolens* in floral morphology and to *P. cracens* in vegetative morphology.

28. **Pimelea suaveolens** Meissner in Lehm., Pl, Preiss. 1: 603-604 (1845). — *Calyptrostegia suaveolens* (Meissner) Endl., Gen. Pl. Suppl. 4: 61 (1848). *Type:* "Greenmountain" [Greenmount], Perth, Western Australia, 13 Sept. 1839, *L. Preiss* 1268 (lecto here designated: LD; isolecto: MEL, NY); south-western Australia, *J. Drummond* 548 (isosyn: MEL).

Shrub, erect, 0.25-1.2 m high, often multi-stemmed at ground level, unbranched or with few branches and open above, regenerating vegetatively from a fusiform underground swelling. *Stems* yellowish first then red-brown near each inflorescence, becoming grey-brown or pale grey then medium to dark grey further from apex, glabrous except for axillary hairs. *Leaves* opposite, antrorse or sometimes patent, tending to all point vertically when on an oblique to horizontal portion of stem, glabrous; petiole up to 2.3 mm long, lamina concolorous, usually either medium green or glaucous, narrowly ovate to narrowly obovate or ovate to obovate, 5-34 x 1.5-6 mm, thick, adaxially concave, acute or obtuse. *Peduncle* 1-4 mm long. *Involucral bracts* in 4-7 pairs, sometimes becoming reflexed in fruit, more yellowish or rarely more reddish than leaves, often pale brown in fruit, narrowly ovate to broadly elliptic, 6-28 x 3-14 mm; outermost 2 or 4 bracts glabrous outside, sometimes ciliate, usually at least partially hairy

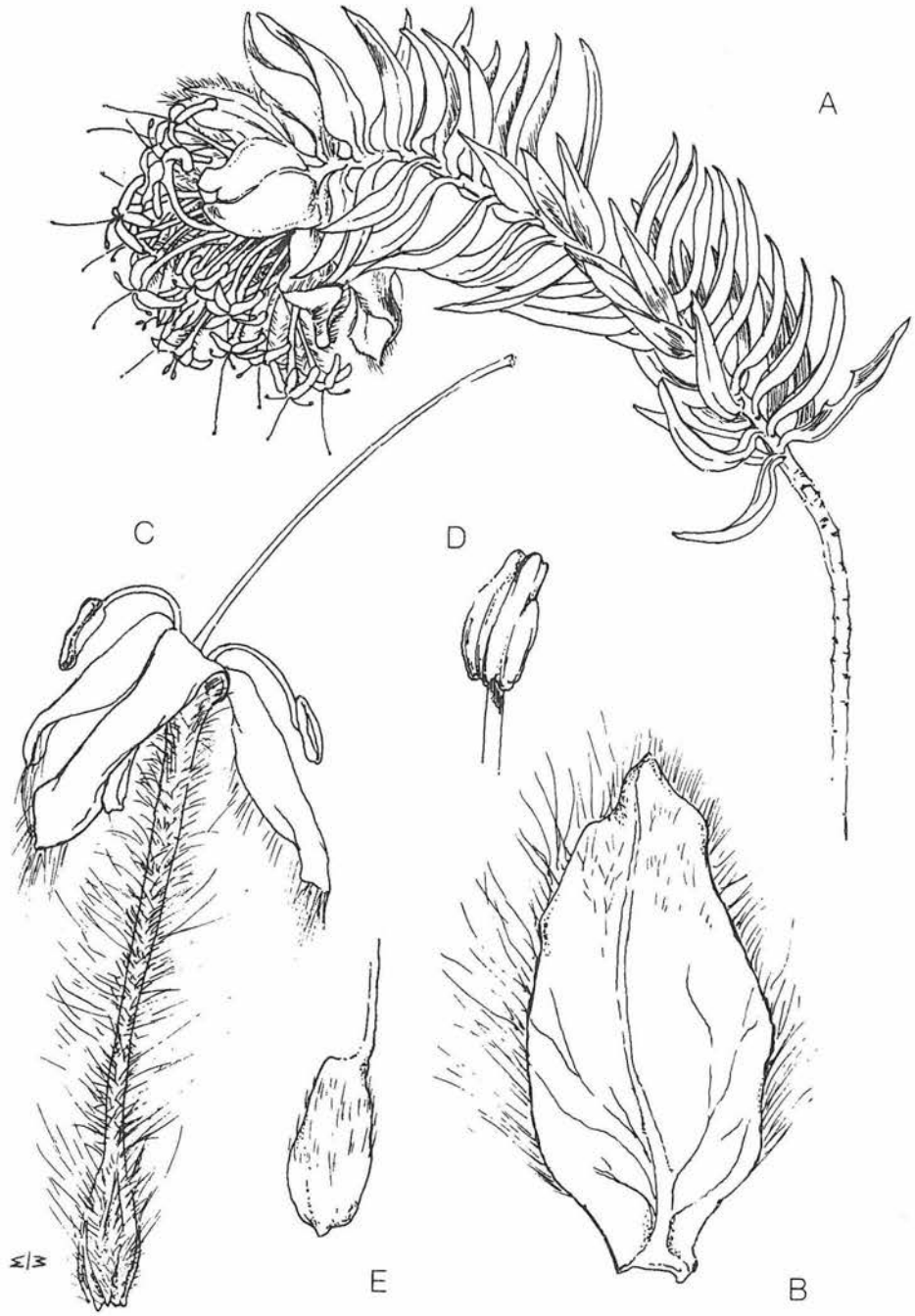

Figure 40. *Pimelea suaveolens* subsp. *suaveolens*. A- flowering stem; B- bract (x 4); C- flower (x 5.5); D- anther (x 14); E- ovary (x 14). Drawn from fresh material represented by *J.R. Wheeler* (Darlington, July 1983).

inside, the cilia and other hairs shorter than those on inner bracts; inner and medial bracts glabrous outside or the innermost ones hairy, usually moderately densely covered inside by appressed to antrorse hairs shorter than or as long as the cilia, sometimes subglabrous or glabrous inside, densely ciliate or the medial bracts moderately densely ciliate; longest cilia

occurring near middle of each margin, (1-)2-5 mm long, very fine. *Inflorescence* pendulous or very rarely erect, compact. *Pedicels* usually c. 1 mm long; longest hairs 1.5-2.5 mm long. *Flowers* bisexual or very rarely female, dark-coloured below circumscission point, pale to deep yellow above; tube (8-)9-18 mm long, circumscissile 1.5-4 mm above ovary-portion, glabrous inside. *Ovary-portion of floral tube* 1.5-3 x c. 1 mm, with appressed to patent hairs 0.1-0.6 mm long, which are often mixed in distal part with long hairs usually 2-3 mm long. *Style-portion of floral tube* very narrowly cylindric, scarcely enlarged at summit, 7-15 mm long, 0.8-1.1 mm diam. at summit, with a mixture of hairs of varied lengths, some hairs minute and some medium-sized to long; minute hairs patent, usually 0.1-0.3 mm long; longer hairs patent or widely antrorse, becoming progressively shorter from base upwards, those below circumscission point 2-5 mm long and sometimes distinctly coarser than those above, those at middle of tube 1-3.5 mm long and very fine, those at summit (when present) 1-2 mm long. *Sepals* narrowly ovate to ovate, (2.5-)3-6 mm long, the indumentum on outside similar to that of distal part of floral tube, glabrous inside or with a few minute inconspicuous hairs below apex. *Stamens* shorter than or as long as (rarely exceeding) sepals; filament 1.5-3.5 mm long; anther 0.7-1.6 x 0.3-0.4 mm; connective narrower than anther; slits semi-lateral to almost adaxial after dehiscence. *Ovary* moderately densely hairy; hairs appressed, very fine, the longest ones 0.3-0.4 mm long. *Style* exserted by 2-6.5 mm. *Seed* c. 6 x 2 mm, with longitudinal rows of minute pits. (Figures 40, 41.)

Distribution. (Figure 44.) Extends from near Jurien Bay south-east to Albany and inland to near Coolgardie.

Flowering period. June-October.

Affinities. Closest to *Pimelea tinctoria* in floral morphology but with leaves more similar to *P. aeruginosa.*

Notes. Two subspecies are recognised. They appear to be geographically allopatric from the available collections. Specimens occurring at the edges of the apparent disjunction tend to be somewhat intermediate in morphology between the two subspecies.

Key to Subspecies

1. Leaves not glaucous. Inner involucral bracts yellowish green or green or sometimes pale brown or reddish. Floral tube 12-18 mm long .....28a. subsp. *suaveolens*
1. Leaves glaucous. Inner involucral bracts yellow or rarely yellowish green. Floral tube 8-14 mm long.....28b. subsp. *flava*

28a. subsp. **suaveolens**

Pimelea menkeana Lehm. ex Meissner in Lehm., Pl. Preiss. 1: 604 (1845). — *Calyptrostegia menkeana* (Lehm. ex Meissner) Endl., Gen. Pl. Suppl. 4: 61 (1848). — *Pimelea suaveolens* var. *menkeana* (Lehm. ex Meissner) Diels & E. Pritzel, Bot. Jahrb. Syst. 35: 395 (1904). *Type:* south-western Australia, Oct. 1840, *L. Preiss* 1269 (lecto here designated: LD; isolecto: MEL, NY).

Leaves: lamina not glaucous, narrowly ovate or narrowly elliptic to elliptic, (5-)9-34 x (1.5-)2.5-6 mm, acute or narrowly obtuse, sometimes mucronulate. *Involucral bracts* usually yellowish green, sometimes green or rarely somewhat reddish, narrowly ovate to narrowly elliptic or ovate to elliptic, 10-28 x 5-14 mm; innermost bracts glabrous outside. *Floral tube* 12-18 mm long. *Sepals* 3.5-5.5 mm long. *Stamens* shorter than sepals; anther 1.2-1.6 mm long. (Figure 40.)

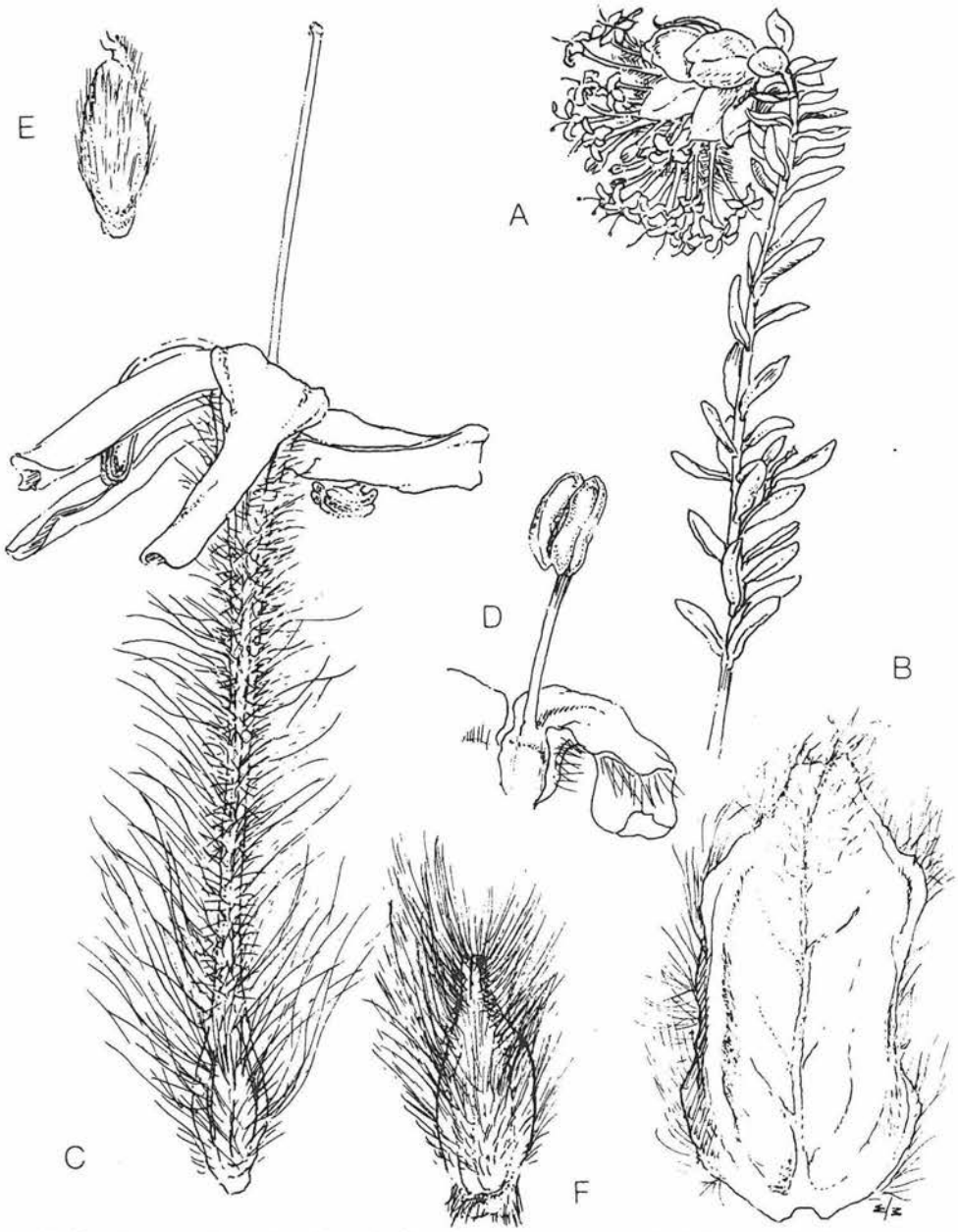

Figure 41. *Pimelea suaveolens* subsp. *flava*. A- flowering stem; B- bract (x 6); C- flower (x 9); D- stamen (x 12); E- ovary (x 12); F- enclosed fruit (x 5). Drawn from fresh material represented by *N. Cohen* 1026.

Specimens examined. WESTERN AUSTRALIA (selected from over 160 seen): Stirling Range, near Warrungup, *A.M. Ashby* 2665 (AD, PERTH); Mount Barker, *S.T. Blake* 20857 (BRI); Narrogin, *N.T. Burbidge* 2316 (CANB); 10.7 mi [17 km] from Pemberton towards Nannup, 15 Oct. 1968, *E.M. Canning* (CBG); Red Hill, *R.J. Cranfield* 412 (PERTH); c. 5 km NE of Jarrahdale, *N.N. Donner* 1457 (AD); 8 km W of Gidgegannup, *M. Fagg* 1044 (CBG); 2 km NW of Mt Lesueur, *E.A. Griffin* 1962 (PERTH); Logue Brook Dam, *T.A. Halliday* 206 (AD, CANB, PERTH); Wooroloo, *M. Koch* 1390 (BRI); Kelmscott, *A. Morrison* 9234

(BRI); Gingin, *A. Morrison* 12173 (PERTH); 6 km W of Lake King, *K. Newbey* 2703 (PERTH); 3 mi [5 km] from Tallanalla towards Harvey, *M.E. Phillips* 4068 (CBG, MEL); Rosa Glen, Margaret River, *R.D. Royce* 2765 (PERTH); near Yarloop, *F.W. Went* 232 (PERTH).

Distribution. (Figure 44.) Extends from Mt Lesueur (30°11' S, 115°12' E) south to Cape Naturaliste (33°32' S, 115°00' E) and from there to Albany (35°02' S, 117°53' E) and east of the Stirling Range (c. 34°50' S, 118°28' E).

Habitat. Usually occurs in sandy clay, always recorded with gravel or laterite rocks or underlying laterite, in forests or woodlands or sometimes shrublands, often on hillsides.

Flowering period. June-October.

Notes. The hairs on the floral tube in this subspecies are usually longer than those in *Pimelea suaveolens* subsp. *flava* but some specimens of *P. suaveolens* subsp. *suaveolens* from the southern part of the range have small hairs. The involucral bracts, especially the innermost ones, are usually less hairy than in *P. suaveolens* subsp. *flava*.

28b. subsp. **flava** Rye, subsp. nov. (Figure 41.)

Differt a *P. suaveolente* Meissner subsp. *suaveolente* foliis glaucis, bracteis intensius flavis et plerumque floribus minoribus.

Typus: 9.6 km S of Bodallin on South Bodallin Rd, Western Australia, 27 Aug. 1983, *N. Cohen* 1027 (holo: PERTH; iso: CANB, K, MEL, NSW).

Differs from *P. suaveolens* Meissner subsp. *suaveolens* in the glaucous leaves, more deeply yellow involucral bracts and usually smaller flowers.

Leaves: lamina somewhat to very glaucous, narrowly elliptic to elliptic or narrowly obovate to obovate, 5-13 x 1.5-6 mm, acute to obtuse, not mucronate. *Involucral bracts* yellow or rarely yellowish green or the outer ones partly green, elliptic or sometimes broadly elliptic, 6-16 x 3.11 mm; innermost bracts often hairy outside. *Floral tube* (8-)9-14 mm long. *Sepals* (2.5-)3-4 mm long. *Stamens* shorter than to slightly exceeding sepals; anther 0.7-1.4 mm long.

Specimens examined. WESTERN AUSTRALIA (selected from over 55 seen): 2 mi [3 km] W of Gilgai Siding, *T.E.H. Aplin* 1972 (BRI, PERTH); Koorarawalyee, *A.M. Ashby* 2847 (AD, BRI, PERTH); Hyden, *M. Barrow* 44 (PERTH); between Burracoppin and Moorine Rock, *J.S. Beard* 6219 (PERTH); Frank Hann National Park, *D. Butcher* 308 (PERTH); c. 18.9 km WSW of Coolgardie, *R.J. Chinnock* 3092 (AD); 8 mi [13 km] N of Bodallin, *C.F. Davies* 254 (PERTH); 2 mi [3 km] SW of Queen Victoria Rock, *R. Filson* 8903 (MEL); 0.5 mi [0.8 km] S of Lake King, *F. Lullfitz* 5530 (PERTH); 80 km WNW of Kumarl, *T.B. Muir* 4374 (MEL); 22-23 mi [35-37 km] W of Southern Cross, 10 Sept. 1968, *M.E. Phillips* (CBG, PERTH); Cramphorne, N of Narembeen, *R.D. Royce* 7849 (PERTH); Mt Caroline, 1892, *M. Sewell* (MEL); Mt Gibbs, Dec. 1929, *H. Steedman* (PERTH); Muntadgin, *T.W. Stone & E.T. Bailey* 813 (PERTH); 90 Mile Tank, c. 80 km W of Daniell, *P. Wilson* 3206 (AD).

Distribution (Figure 44) Extends from Mt Caroline (33°48' S, 117°38' E) in the west to near Coolgardie (c. 30°57' S, 120°58' E) in the north-east and to near Peak Charles (32°46' S, 121°17' E) in the south-east.

Habitat. Occurs in sand or sandy clay, usually with gravel or laterite rocks or underlying laterite, probably in shrublands or open mallee woodlands.

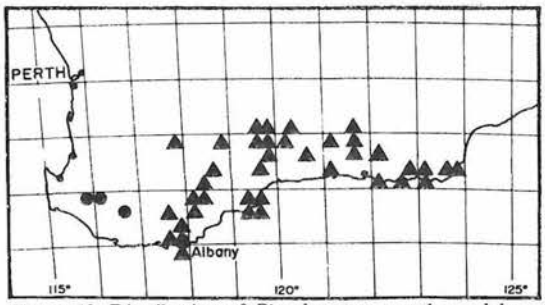

Figure 42. Distribution of *Pimelea cracens* subsp. *glabra* ● and *P. cracens* subsp. *cracens* ▲.

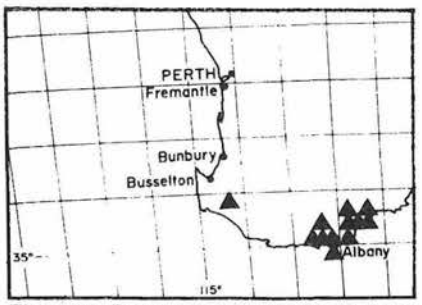

Figure 43. Distribution of *Pimelea tinctoria.*

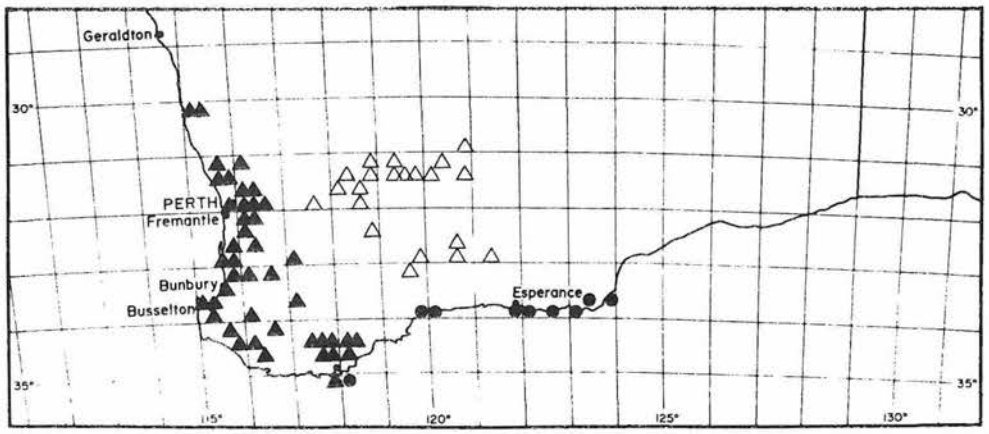

Figure 44. Distribution of *Pimelea suaveolens* subsp. *suaveolens* ▲, *P. suaveolens* subsp. *flava* △ and *P. drummondii* ●.

Flowering period. July-October.

Derivation of name. Flavus (L.) yellow, referring to the involucral bracts.

Notes. Both the flowers and bracts tend to be a deeper yellow in this subspecies than in *Pimelea suaveolens* subsp. *suaveolens.*

29. **Pimelea drummondii** (Turcz.) Rye, comb. nov. (Figure 45.).

Calyptrostegia drummondii Turcz., Bull. Soc. Imp. Naturalistes Moscow 25/2: 178-179 (1852). *Type:* south-western Australia, 1848, *J. Drummond* coll. 5, n. 426 (hol: KW, n.v., seen by N.G. Marchant pers. comm.; iso: MEL, NY).

Shrub, erect, 0.4-2 m high, single-stemmed and up to 25 mm diam. at ground level. *Stems* usually pale yellow-brown or pale green near each inflorescence and becoming red-brown then dark grey further from apex, glabrous except for axillary hairs. *Leaves* opposite, antrorse to patent or rarely slightly reflexed, sessile, concolorous, medium green, narrowly elliptic to elliptic or broadest slightly below middle, 10-48 x 4.5-18 mm, flat, usually acute. *Peduncle* 1-4 mm long. *Involucral bracts* 6, 8 or sometimes more, paired, usually pale green to yellow-green, the outer bracts with a reddish base or central stripe, the inner bracts rarely reddish, greatly overlapping laterally and tightly enclosing basal half of inflorescence, usually rather suddenly recurved at apex, not becoming reflexed, glabrous inside and outside; outermost and medial bracts ovate or broadly ovate, 11-21 x 7-18 mm, recurved in distal 2-7 mm, not ciliate; innermost bracts tending to be smaller than outermost or medial bracts, ciliate, the

cilia 2-2.5 mm long. *Inflorescence* pendulous or sometimes erect, compact. *Pedicels* up to 2 mm long; hairs mostly 1-3 mm long. *Flowers* bisexual, white or cream, glabrous inside; tube 19-27 mm long, without definite ovary- and style-portions but broader below the slightly constricted circumscission point than above, the broader proximal portion much longer than ovary. *Proximal portion of floral tube* 8-10 x c. 1 mm, with deciduous antrorse hairs 3.4 mm long, glabrous in fruit. *Distal portion of floral tube* very narrowly cylindric except near summit, 11-17 mm long, c. 1.5 mm diam. at summit, with patent hairs; hairs variable in length, the longest hairs 2-3.5 mm long, the smallest hairs usually c. 0.5 mm long. *Sepals* ovate, 4-5 mm long, with hairs similar to those on distal part of floral tube. *Stamens* slightly exceeding sepals; filament 3-4.5 mm long; anther 1.4-2 x 0.5-0.6 mm; connective much narrower than anther; slits semi-lateral after dehiscence. *Ovary* glabrous. *Style* exserted by 3-5 mm. *Seed* c. 6.5 x 1.7 mm, with longitudinal rows of small but well developed pits.

Specimens examined. WESTERN AUSTRALIA (selected from over 40 seen): between Mt Baring and Mt Ragged, *J.S. Beard* 5337 (PERTH); second beach W of Nanarup, 1982, *D. Davidson* (PERTH); Duke of Orleans Bay, *H. Demarz* 6297 (PERTH); c. 8 km W of Israelite Bay, *N.N. Donner* 2827 (PERTH); near Cape Le Grande, *C.A. Gardner* 14133 (PERTH); c. 30 km W of Mt Ragged, *R.H. Kuchel* 1638 (PERTH); 3 mi [5 km] N of Esperance, *K. Newbey* 2564 (PERTH); Dempster Head, Esperance, *B.L. Rye* 82021 (PERTH); Esperance, *B.L. Turner* 5528 (MEL); East Mt Barren, *E. Wittwer* 372 (PERTH); Frenchmans Peak, *J.W. Wrigley* 685400 (CANB).

Distribution. (Figure 44.) Extends from Mt Gardner (35°00' S, 118°11' E) east to near Israelite Bay (33°37' S, 123°49' E), always within 40 km of the coast.

Habitat. Mainly recorded on sand dunes or sandy soil overlying granite.

Flowering period. June-August.

Affinities. No close relatives but certainly has affinities with *Pimelea suaveolens* and its allies, including the South Australian species *P. macrostegia*. Its leaves are rather similar to those of *P. physodes*.

Notes. The name *Pimelea macrocephala* Hook., which was published prior to *Calyptrostegia drummondii* Turcz., has often been applied to this taxon because both descriptions cite the single collection of *J. Drummond* coll. 5, n. 426. However, the description given by Hooker matches the accompanying illustration of cultivated material rather than the Drummond specimen cited. No herbarium specimen derived from the cultivated material has been located, so the illustration is taken to be the type. Hooker's description and illustration resemble *P. floribunda* very well except perhaps in the description of the flower colour as a very pale rose. Certainly the description and illustration do not match *P. drummondii*, particularly in regard to the shape and orientation of the leaves. *Pimelea macrocephala* is regarded here as a nomen dubium.

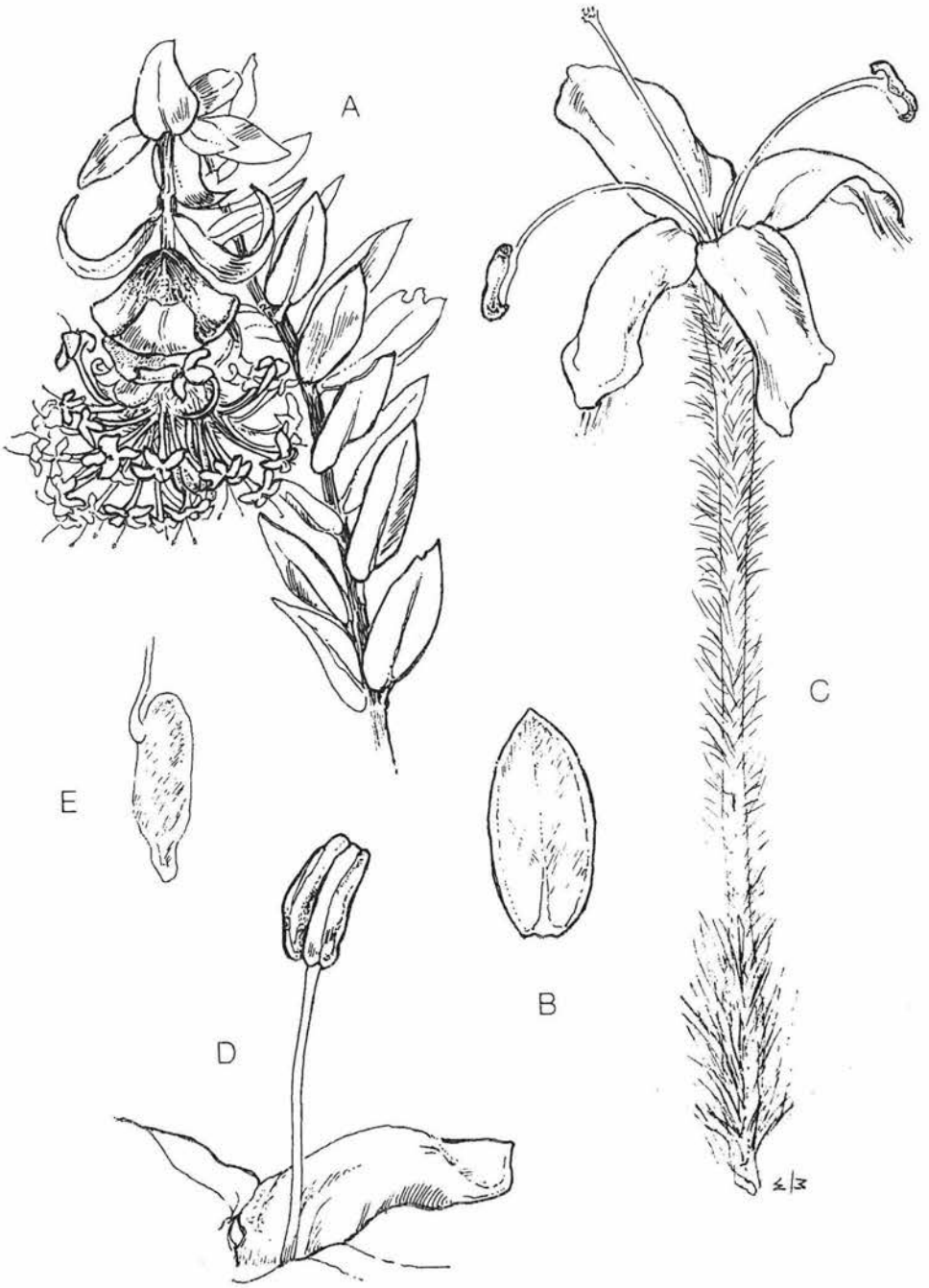

Figure 45. *Pimelea drummondii*. A- flowering stem; B- leaf; C- flower (x 6); D- stamen (x 10); E- ovary (x 10). Drawn from fresh material represented by *N. Cohen* 1003.

Sect. 5. **Macrostegia**

Pimelea sect. *Macrostegia* (Turcz.) Rye, comb. nov. — *Macrostegia* Turcz., Bull. Soc. Imp. Naturalistes Moscou 25/2: 177 (1852). *Type: M. erubescens* Turcz. (= *P. physodes* Hook.).

Shrubs, hermaphrodite or gynodioecious. *Stems* glabrous except for inconspicuous hairs in upper leaf axils; nodes abaxially prominent, c. twice as thick as base of leaf. *Leaves* opposite, sessile or subsessile, glabrous. *Involucral bracts* highly differentiated from leaves, closely surrounding flowers, not becoming reflexed, very large, colourful, hiding flowers laterally, glabrous. *Inflorescence* head-like, terminal, pendulous, compact, many-flowered; receptacle well developed. *Pedicels* with dense antrorse to appressed hairs. *Flowers* hairy outside, glabrous inside. *Floral tube* circumscissile above ovary, prominently constricted at circumscission point; proximal portion (below circumscission point) extended well above ovary, with deciduous hairs; distal portion cylindric, longer or sometimes as long as portion below constriction and often broader, broad throughout rather than only towards summit. *Sepals* erect, elongate. *Stamens* 2, very long; connective narrower than anther; slits lateral after dehiscence. *Ovary* glabrous. *Style* filiform, very long; stigma small, papillose. *Fruit* dry, enclosed in the persistent enlarged base of the floral tube.

A section of 1 species, occurring in south-western Western Australia.

Notes. This section is undoubtedly closest to sect. *Calyptrostegia* but has a number of unique characters. It differs from all other sections primarily in the shape of the floral tube and sepals, in the sepals being both erect and free and in the extremely long stamens and style. The involucral bracts are the largest and most showy in the genus. The single member of sect. *Macrostegia, P. physodes*, is probably the only bird-pollinated species in the genus and this may account for its very distinctive floral features.

30. **Pimelea physodes** Hook., Icon. Pl. 9: t. 865 (1851). — *Banksia physodes* (Hook.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* south-western Australia, 1848, *J. Drummond* coll. 5, n. 424 (lecto here designated: K; isolecto: KW, n.v.); south-western Australia, *J. Drummond* suppl. n. 84 (syn: K; isosyn: MEL).

Macrostegia erubescens Turcz., Bull. Soc. Imp. Naturalistes Moscou 25/2: 177-178 (1852). *Type:* south-western Australia, 1848, *J. Drummond* coll. 5, n. 424 (holo: KW, n.v., photo in PERTH; iso: K).

Shrub, nearly always erect, spindly or open, 0.2-1 mm high, single-stemmed at ground level. *Stems* yellowish or deep red to purple near each inflorescence, becoming medium grey-brown further from apex. *Leaves* opposite, antrorse, concolorous, medium green, ovate to elliptic or narrowly so, (8-)12-32 x (3-)5-11 mm, flat or concave on adaxial surface, acute to obtuse. *Peduncle* 3-14 mm long. *Involucral bracts* 6, 8 or rarely 4, sometimes almost completely pale green to cream, more commonly with reddish portions or completely red to purple, the outer bracts usually with the most red to purple colouring, elliptic to broadly elliptic, 22-60 x 11-45 mm, glabrous. *Pedicels* usually 0.7-1 mm long; hairs 1-2.5 mm long. *Flowers* bisexual or rarely female, green or creamy green with a reddish style; tube 6-9 mm long, circumscissile and strongly constricted c. 3 mm above base and c. 1 mm above ovary. *Proximal portion of floral tube* (below constriction) usually 3-4 x c. 1.5 mm, with deciduous antrorse hairs 1.5-2.5 mm long, glabrous in fruit. *Distal portion of floral tube* (above constriction) cylindric, 3-5.5 x 1.5-2 mm, with very fine antrorse to patent hairs mostly 0.5-1.5 mm long, the longest hairs up to 3 mm long. *Sepals* very narrowly triangular, 5-9 mm long, with hairs similar to those on distal portion of floral tube but sometimes less densely hairy. *Stamens* greatly exceeding sepals; filament 11.5-16 mm long; anther 2-3 x 0.2-0.3 mm. *Staminodes* of female flowers: filament c. 8 mm long; anther c. 1 mm long. *Style* exserted by 18-23 mm. *Seed* c. 6 x 1.5 mm, with longitudinal rows of shallow pits. (Figure 46.)

Figure 46. *Pimelea physodes.* A- flowering stem; B- flower (x 8); C- stamen (x 8); D- ovary (x 12). Drawn from *A.S. George* 10063 (B, C, D) and fresh material represented by *K. Newbey* 9844 (A).

Specimens examined. WESTERN AUSTRALIA (selected from over 55 seen): c. 8 km W of Ravensthorpe, *D.G. Austin* 197 (AD); 50 km NW of Ravensthorpe, *T.C. Daniell* 23 (PERTH); Phillips River, *C.A. Gardner* 1917 (PERTH); Mt Short, *C.A. Gardner* 16116 (PERTH); Thumb Peak Range, *A.S. George* 7118 (PERTH); East Mt Barren, *T.E. George* 651 (MEL); West Mt Barren, *Hook* 294 (MEL); c. 20 km WNW of Ravensthorpe, *S.D. Hopper*

887 (PERTH); Jerramungup, *F. Lullfitz* 3511 (PERTH); 8 mi [13 km] W of Pabelup Lake, *K. Newbey* 491 (PERTH); No Tree Hill, 1 Nov. 1962, *M.E. Phillips* (CBG); NW corner of Fitzgerald River National Park, *R.A. Saffrey* 1442 (PERTH); 39 km S of Ravensthorpe along road to Hamersley River estuary, *I.R. Telford* 8621 (CBG); East Mt Barren, 28 Oct. 1968, *J.W. Wrigley* (BRI, CBG).

Distribution. (Figure 47.) Extends from near Lake Pallarup (c. 33°15' S, 119°43' E) south to Fitzgerald River National Park (34°04' S, 119°26' E) and from Jerramungup (33°56' S, 118°55' E) east to Desmond (33°38' S, 120°08' E).

Habitat. Occurs in sand, often with gravel or rocks, on plains or hillsides.

Flowering period. July-October.

Affinities. Pimelea physodes is similar in vegetative characters to some specimens of *P. drummondii.* Although very distinctive in its floral morphology, *P. physodes* is clearly closest to *P. drummondii.* Like *P. drummondii*, it loses the hairs of the proximal portion of the floral tube very readily and is glabrous outside in fruit.

Notes. The bell-like inflorescence of *P. physodes* bears a striking resemblance to the 'bells' of a number of *Darwinia* species occurring mainly in the Stirling Range, particularly to *D. macrostegia* (Turcz.) Benth. The parallel evolution in the two genera of pendulous flower heads with large colourful bracts hiding the elongate flowers from side view is apparently related to the adaptation of the species concerned to bird pollination. Keighery (1975) recorded *Phylidonyris melanops*, the Tawny-crowned Honeyeater, as a probable pollinator of *P. physodes.*

Sect. 6. **Stipostachys**

Stipostachys Rye, sect. nov.

Caules pallidi, glabri; nodi abaxialiter non ultra petiolum protrudentes. Involucri bracteae 4-12, saepe deciduae. Inflorescentia maturitate elongata, contigua; pedicelli numerosi, in seriebus pluribus longitudinalibus dispositi. Flores bisexuales. Tubus floralis extus tenuiter patenti-pilosus; portio stylaris quam ovarialis longior. Ovarium apice pilosum. Fructus siccus, basi tubi florali persistente inclusum.

Typus: Pimelea haemostachya F. Muell.

Shrubs or *partially herbaceous perennials,* hermaphrodite. *Stems* pale-coloured, glabrous; nodes not protruding abaxially beyond the petiole. *Leaves* usually opposite and decussate, shortly petiolate, glabrous; lamina concolorous. *Involucral bracts* 4-12, often deciduous, sessile, papery and pale-coloured at maturity, broader than leaves. *Inflorescence* terminal, erect, compact at first, elongate at maturity, continuous. *Rachis* and *pedicels* with short hairs and long antrorse to patent hairs, the pedicels numerous and in many longitudinal rows. *Floral tube* with fine patent hairs outside and often inside, circumscissile or (in Western Australia) fully persistent but sometimes irregularly tearing above ovary; style-portion much longer than ovary-portion. *Sepals* spreading, hairy outside, glabrous inside. *Stamens* 2; connective narrower than anther; slits semi-lateral after dehiscence. *Ovary* hairy at apex. *Style* exserted, filiform; stigma small, papillose. *Fruit* dry, enclosed in persistent base of floral tube.

A section of 3 species, of which 1 occurs mainly in the Pilbara, Western Australia and 2 occur in Queensland.

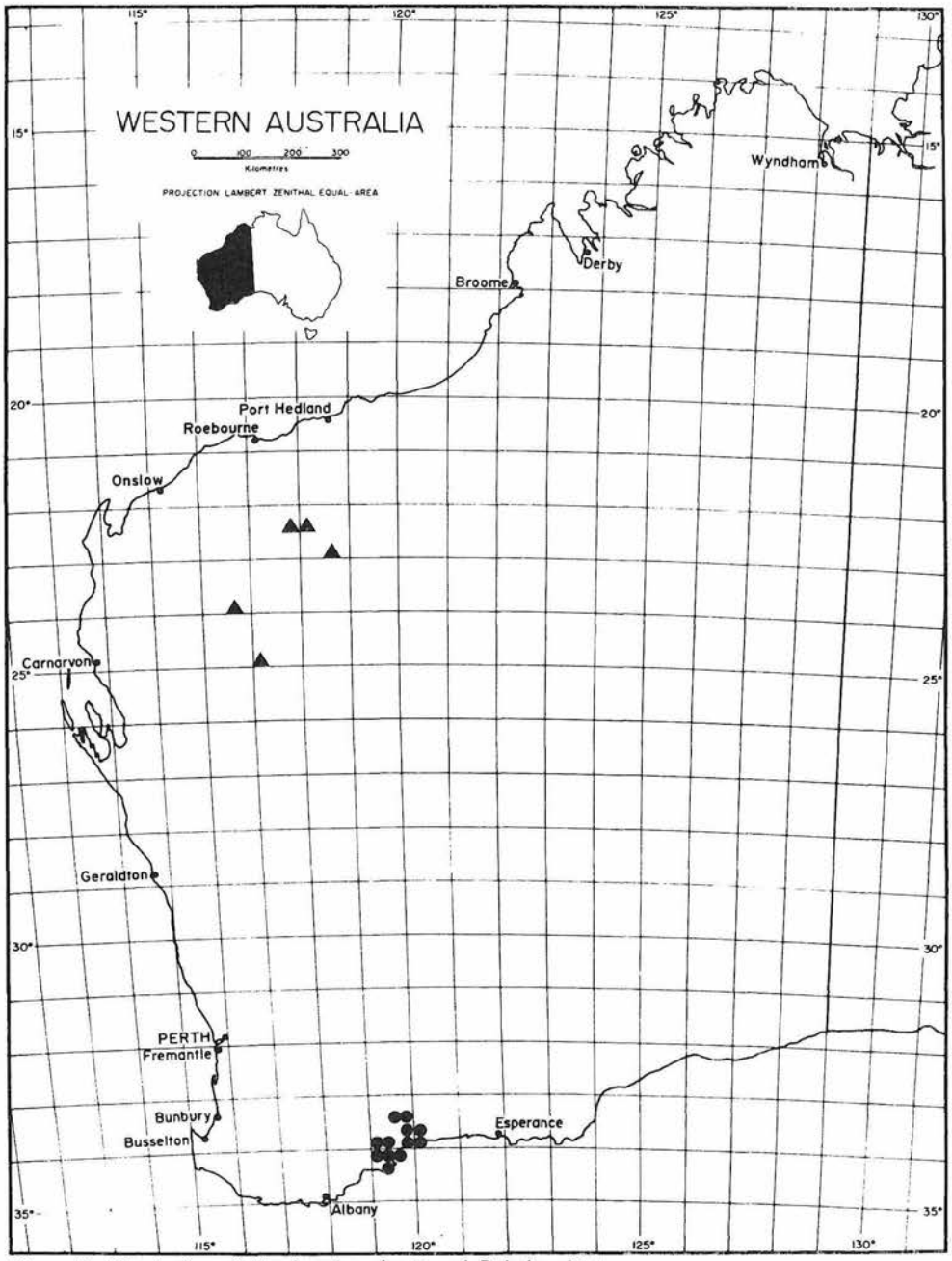

Figure 47. Distribution of *Pimelea physodes* ● and *P. holroydii* ▲.

Notes. Two species of sect. *Stipostachys* were described prior to Bentham's treatment (1873) but none had been described prior to the earlier publications giving infrageneric classifications of *Pimelea*. Bentham separated *P. haemostachya* and *P. holroydii* into sect. *Calyptrostegia* subsect. *Choristachys* and sect. *Epallage* respectively (both groups are here included under sect. *Epallage* except for the type species of *Choristachys*) but noted a possible relationship between the two species. Together with *P. decora*, these species form a quite distinct section, which is unusual in having non-prominent nodes. It has a continuous-elongate inflorescence,

which can extend to over 200 mm long but remains dense, the flowers in many longitudinal rows. The upper floral tube seems to be odd in that it tends, at least when dried, to be square in cross-section but this character needs to be examined further. Its closest affinities are with sect. *Calyptrostegia* while it also shows some similarity to sect. *Heterolaena.*

31. **Pimelea holroydii** F. Muell., Fragm. 6: 159-160, t. 59 (1868). — *Banksia holroydii* (F. Muell.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type*: Hamersley Range, Western Australia, date unknown, *C. Harper* 16 (holo: MEL).

Shrub, erect, 0.3-1 m high, single-stemmed at ground level. *Stems* very pale yellow-brown in the distal 100-300 mm, becoming red-brown further from apex. *Leaves* opposite or subopposite; petiole 0.5-2 mm long; lamina more or less medium green or bluish green, often with black patches when dried, ovate or broadly ovate, 12-37 x 6-20 mm, flat, obtuse; midvein and several lateral veins pale yellow-brown in the proximal half of the lamina, becoming indistinct above, prominent on abaxial surface. *Peduncle* usually 5-30 mm long. *Involucral bracts* 4-7, the same colour as leaves at first but becoming pale yellow-brown in fruit, broadly ovate or rarely ovate, 9-20 x 7-16 mm, glabrous outside, usually ciliate especially around apex, hairy throughout the inner surface or with hairs concentrated in the centre-base, dry and chartaceous in fruit, persistent but with portions sometimes breaking off; cilia 1-4 mm long, very fine, silky. *Inflorescence* initially compact and head-like but elongating as flowering proceeds; rachis narrowly conic and usually 13-30 mm long at maturity. *Pedicels* 0.5-1 mm long, with mixed long and short hairs, the long hairs 1.5-3.5 mm long, the short hairs 0.2-0.5 mm long. *Flowers* white or sometimes cream, not circumscissile but sometimes breaking irregularly above the ovary, glabrous inside; floral tube 10-12 mm long. *Ovary-portion of floral tube* 2-3 x 0.7-1 mm, very densely hairy; hairs antrorse, 0.5-1.5 mm long. *Style-portion of floral tube* 8-9 x c. 0.7 mm, with a mixture of long hairs 2-2.5 mm long and minute hairs 0.2-0.3 mm long in proximal half, shortly hairy above. *Sepals* elliptic, 2.5-3 x 1-1.7 mm. *Stamens* slightly shorter than to slightly exceeding sepals; filament 2-2.5 mm long; anther 1.2-1.5 x 0.4-0.7 mm. *Ovary* c. 2 mm long; hairs 1-1.3 mm long. *Style* exserted by 1.5-4 mm. *Seed* 4-4.5 x 1.5-1.8 mm, with longitudinal rows of shallow pits. (Figure 48.)

Specimens examined. WESTERN AUSTRALIA (selected from over 15 seen): Wanna Station, *J.S. Beard* 6084 (NSW, PERTH); 21 mi [34 km] E of Hamersley Station, *H. Demarz* 2851 (PERTH); 10 km S of Hamersley Homestead, *H. Demarz* 7102 (CANB, PERTH); between Port Hedland and Fortescue River, Oct. 1946, *C.M. Donald* (CANB, MEL); 2 km SE of Dingo Bore, Mt James Station, *T.L. Setter* 378 (ADW); 5 km E of Juna Downs Homestead, *M.E. Trudgen* 358 & *G. Marton* (PERTH).

Distribution. (Figure 47.) Extends from Hamersley Station (c. 22°15' S, 117°50' E) east to Yuna Downs (c. 22°51' S, 118°32' E) and south-west to Wanna Station (23°55' S, 116°33' E) and Mt James Station (24°51' S, 117°13' E).

Habitat. Recorded in red clayey soil.

Flowering period. Recorded January-February and August-October.

Affinities. A very distinct species, closest to the two other members of sect. *Stipostachys, Pimelea haemostachya* and *P. decora,* both of which occur in Queensland.

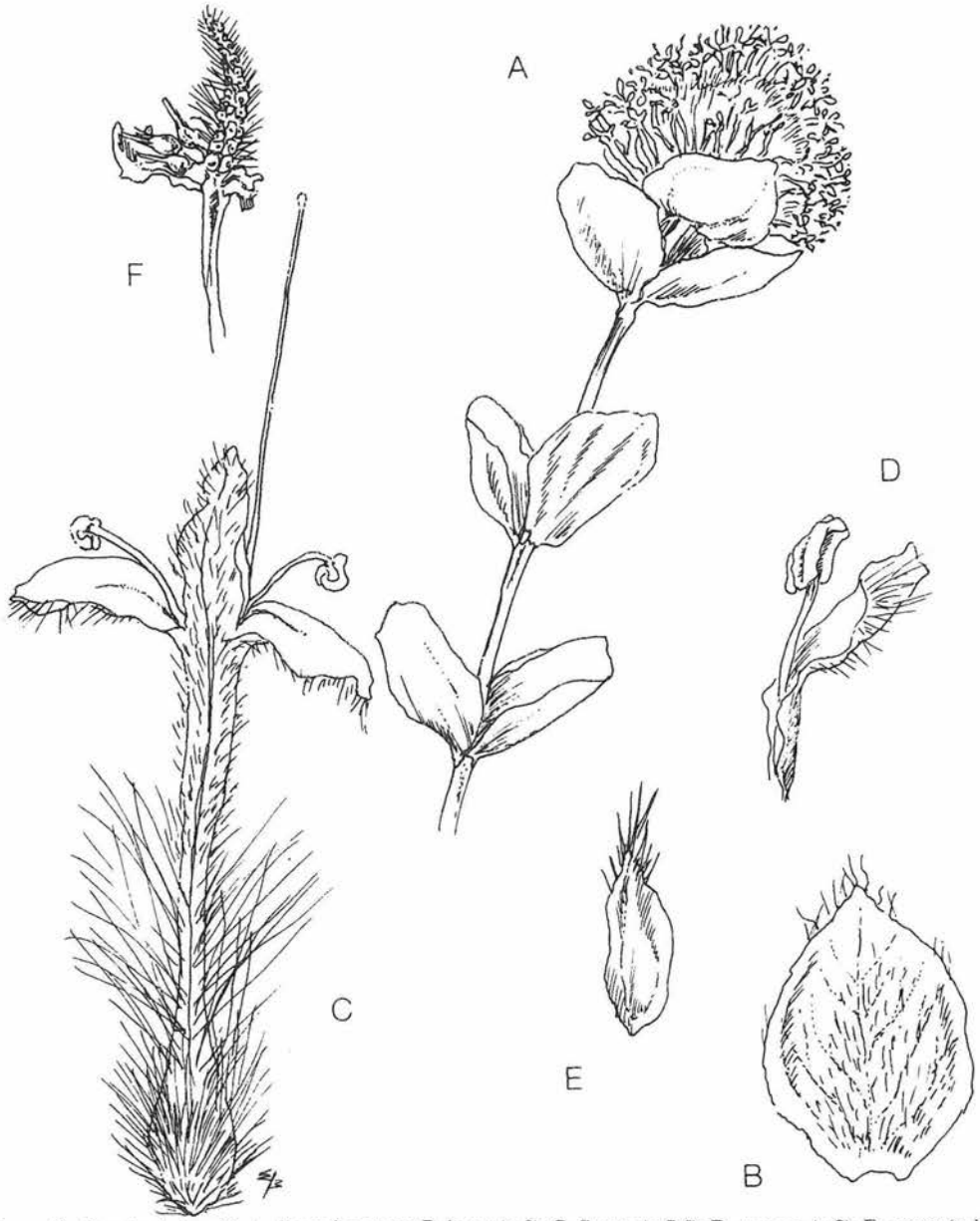

Figure 48. *Pimelea holroydii*. A- flowering stem; B- bract (x 3); C- flower (x 7.5); D- stamen (x 8); E- ovary (x 12); F- fruiting inflorescence (x 1.5). Drawn from *J.S. Beard* 4521 (A, B, C, D) and *H. Demarz* 2851 (E, F).

Sect. 7. **Heterolaena**

Pimelea sect. *Heterolaena* (Endl.) F. Muell., Fragm. 6: 159 (1868). — *Pimelea* b. *Heterolaena* Endl., Gen. Pl. 331 (1837). — *Banksia* sect. *Heterolaena* (Endl.) Kuntze (as *Heteroclaena*) in T. Post & Kuntze, Lex. Gen. Phan. 59 (1903). *Type: P. rosea* R. Br. (lecto here designated).

Heterolaena Fischer & C. Meyer, Index Sem. Hort. Petrop. 10: 47 (1845).

Type: P. spectabilis Lindley (as *H. spectabilis* (Lindley) Fischer & C. Meyer).

Shrubs or *undershrubs*, hermaphrodite or gynodioecious, rarely some individuals with bisexual and female flowers. *Stems* glabrous except for inconspicuous hairs in upper leaf axils or rarely (*P. ferruginea*) inconspicuously hairy when young; nodes abaxially prominent, c. twice as thick as petiole. *Leaves* opposite, decussate, glabrous; petiole (when present) usually brown or brownish; lamina often discolorous. *Involucral bracts* in 1-3 (usually 2) pairs, sessile, often with subsessile bract-like leaves below, erect and closely surrounding flowers, not becoming reflexed in fruit, broader and usually more colourful than leaves, glabrous or subglabrous outside, often ciliate laterally but not (except in *P. brevistyla*) around apex. *Inflorescence* terminal, head-like, many-flowered; receptacle very compact, ovoid to more or less flat. *Pedicels* with dense antrorse to appressed hairs. *Flowers* hairy outside. *Floral tube* wholly persistent in fruit or rarely circumscissile above ovary, nearly always with 2 or more distinctly different kinds of hairs, usually with a subbasal to medial band of long patent hairs; ovary-portion usually prominently 8-ribbed; style-portion longer than ovary-portion, broadest at summit, the gradual expansion occurring mainly in the distal half. *Sepals* spreading, persistent or shed with distal part of floral tube. *Stamens* 2; cells usually protruding laterally beyond connective and with slits semi-lateral to lateral after dehiscence, rarely (*P. brevistyla*) laterally exceeded by connective and strictly introrse. *Ovary* glabrous. *Stigma* small, papillose. *Fruit* dry, enclosed in the persistent enlarged base of floral tube, apparently tending to be shed before seed matures.

A section of 14 species, endemic in south-western Western Australia. It is closest to sect. *Calyptrostegia* but also shows some similarities with sect. *Pimelea* and sect. *Stipostachys*.

Notes. The name *Heterolaena* is derived from the Greek words *hetero* (different, unequal, variable) and *chlaena* (cloak), perhaps referring to the variable size of the hairs on the floral tube. When this section was first named, a heterogenous assemblage of species was included, most of which were later referred to sect. *Calyptrostegia*. The lectotype chosen here for the group is a species included by all subsequent authors who have listed species for this section. The genus *Heterolaena* was published after the name *Heterolaena* had been used as an unspecified infrageneric category but without any reference to the previous usage of the name and without citing any of the species included in the earlier publication.

As circumscribed here, sect. *Heterolaena* is a relatively uniform group. It is characterised by the compact flower heads with well defined involucral bracts, by the elongate floral tube, usually with long and short hairs, and by the usual absence of circumscission. Its closest ties are with sect. *Calyptrostegia*.

32. **Pimelea lehmanniana** Meissner in Lehm., Pl. Preiss. 1: 603 (1845). — *Calyptrostegia lehmanniana* (Meissner) Endl., Gen. Pl. Suppl. 4: 61 (1848). — *Banksia lehmanniana* (Meissner) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type*: "Mt Wuljenup" [Willyung Hill], Western Australia, 14 Oct. 1840, *L. Preiss* 1271 (lecto here designated: LD; isolecto: MEL, NY).

Shrub, erect, 0.3-1.2 m high, single-stemmed at ground level. *Stems* usually dark reddish brown near each inflorescence, dark grey-brown further from apex. *Leaves* antrorse or patent; petiole usualy 0.5-1.3 mm long; lamina discolorous, dull yellowish green to grey-green on abaxial surface, darker bluish green with a sheen on adaxial surface, narrowly obovate to narrowly ovate in most leaves but ovate in a few leaves immediately below the inflorescence, (4-)11-26(-34) x 1-7 mm, up to 8 mm wide in uppermost ovate leaves, flat or slightly recurved at apex, usually acute and/or mucronulate. *Peduncle* 2-17 mm long. *Involucral bracts* 4 or 6, commonly pale yellow-green, sometimes reddish, rarely similar in colour to leaves, ovate or broadly ovate, 13-21 x 7-14 mm; outer bracts often partially hairy inside but with fewer hairs than on inner bracts, not ciliate or rarely with very few cilia; inner bracts partially hairy inside, sometimes ciliate, the longest cilia 1.3-3 mm long. *Inflorescence* erect or pendulous.

Figure 49. *Pimelea lehmanniana* subsp. *lehmanniana*. A- flowering stem; B- inner surface of bract (x 4); C- flower (x 8); D- upper part of flower (x 10). Drawn from fresh material represented by *K. Newbey* 9845.

Pedicels usually 1-2 mm long; hairs up to 3 mm long. *Flowers* bisexual or rarely female, white to pale yellow, sometimes pinkish in bud, not circumscissile or circumscissile 2-3 mm above ovary-portion, hairy inside at the throat and sometimes with a few hairs on base of sepals but otherwise glabrous inside, the longest hairs in throat reflexed and c. 1.5 mm long; tube 8-14 mm long. *Ovary-portion of floral tube* 2-3 x c. 1.2 mm, glabrous or with patent to antrorse hairs 0.1-0.5 mm long. *Style-portion of floral tube* 6-11 mm long, 1-1.5 mm diam. at summit, with long patent to widely antrorse hairs 4-6 mm long, but no short hairs, in the proximal half and antrorse hairs 0.5-1.5 mm long above. *Sepals* ovate or rarely narrowly ovate, 3-5.5 mm long, with a few antrorse hairs, the longest hairs 2-3 mm long. *Stamens* greatly exceeding sepals; filament 5-7 mm long; anther 0.7-1.4 x 0.25-0.6 mm; slits semi-lateral to lateral after dehiscence. *Style* exserted by 6-10 mm. (Figures 49, 50.)

Distribution. (Figure 55.) Extends from the Darling Range near Perth to Fitzgerald River National Park.

Flowering period. August-September.

Affinities. Closest to *Pimelea spectabilis* and *P. rara.*

Notes. The two subspecies recognised here are very distinct and could be regarded as separate species. Treating them as subspecies results in *Pimelea lehmanniana* being perhaps the only species of the genus to have both early-circumscissile and non-circumscissile members. Subspecies rank was chosen for the two taxa because the morphological differences between them are less than those separating all the other pairs of the taxa recognised here as species in sect. *Heterolaena.* Since they do not occur sympatrically, it is not possible to determine whether they are capable of hybridising in nature. Further studies, examining other aspects of their biology, such as anatomy, biochemistry and cytology, might demonstrate better which taxonomic rank is most appropriate.

Key to Subspecies

1. Floral tube circumscissile; ovary-portion hairy.....32a. subsp. *lehmanniana*
1. Floral tube not circumscissile; ovary-portion glabrous.....32b. subsp. *nervosa*

32a. subsp. **lehmanniana**

Shrub, 0.3-1.2 m high. *Leaves* usually slightly recurved. *Peduncle* up to 10 mm long. *Involucral bracts* 4 or very rarely 6 but sometimes with a pair of subsessile bract-like leaves immediately below, ovate or broadly ovate. *Inflorescence* pendulous. *Flowers* bisexual or rarely female, white to pale yellow, circumscissile 2-3 mm above ovary-portion of floral tube. *Ovary-portion of floral tube* with patent to antrorse hairs 0.1-0.5 mm long. *Anthers* 0.7-1.2 x 0.3-0.6 mm. (Figure 49.)

Specimens examined. WESTERN AUSTRALIA (selected from over 55 seen): Stirling Range, *A.M. Ashby* 2016 (AD, PERTH); between Bremer Bay and Gordon Inlet, *M.G. Corrick* 7691 (MEL); Middle Mt Barren, *C.A. Gardner* 9159 (PERTH); West Mt Barren, *A.S. George* 6957 (PERTH); Jerramungup, *F. Lullfitz* 3517 (PERTH); E end of Porongurup Range, *K. Newbey* 1843 (PERTH); Mt Drummond, *K. Newbey* 2690 (PERTH); 7 km E of Mount Barker, *P. Wilson* 3355 (AD); 2 mi [3 km] from Albany towards Denmark, 12 Oct. 1968, *J.W. Wrigley* (CBG).

Distribution. (Figure 55.) Extends from Lake Muir (34°28' S, 116°39' E) east to East Mt Barren (33°55' S, 120°01' E).

Habitat. Recorded in sand and/or gravel, often in ranges of hills.

Flowering period. August-November.

Notes. Pimelea lehmanniana var. *meiocephala* Diels is probably a synonym of this subspecies but is listed as a nomen dubium because there do not appear to be any type specimens still in existence and the description is inadequate to definitely place the taxon.

Figure 50. *Pimelea lehmanniana* subsp. *nervosa.* A- flowering stem; B- inner surface of bract (x 4); C- flower (x 9); D- stamen (x 8). Drawn from fresh material represented by *B.L. Rye* 84001.

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32b. subsp. **nervosa** (Meissner) Rye, comb. et stat. nov. (Figure 50.)

Pimelea lehmanniana var. *nervosa* Meissner in Lehm., Pl. Preiss. 2: 270 (1848). *Type:* south-western Australia, 1843-1844, *J. Drummond* coll. 3, n. 284 ex parte (iso: NY).

Shrub, usually 0.3-0.6 m high. *Leaves* flat or nearly so. *Peduncle* up to 17 mm long. *Involucral bracts* 4 or 6, ovate. *Inflorescence* usually erect, rarely pendulous. *Flowers* bisexual, white but often pinkish in bud, not circumscissile. *Ovary-portion of floral tube* glabrous. *Anthers* 1-1.4 x 0.25-0.4 mm.

Specimens examined. WESTERN AUSTRALIA (selected from over 25 seen): Gleneagle-Jarrahdale road, *T.E.H. Aplin* 1222 (PERTH); Preston River, 1896, *G.H. Berthoud* (MEL); Capel-Donneybrook road, *R.J. Cranfield* 908 (PERTH); between Marradong and Pinjarra, 18 Nov. 1904, *A. Morrison* (PERTH); Gooseberry Hill, 22 Oct. 1910, *A. Morrison* (BRI, CANB); Blackwood River, 1883, *McHard* (MEL); 2 mi [3 km] E of Dwellingup, *K. Newbey* 2627 (PERTH); 3 mi [5 km] from Darkan towards Collie, *M.E. Phillips* 684003 (CBG, PERTH); Jarrahdale, Nov. 1916, *Stoward* (PERTH).

Distribution. (Figure 55.) Extends from Gooseberry Hill (31°5' S, 116°0' E) south to near Donneybrook (33°10' S, 115°10' E).

Habitat. Occurs on the Darling Scarp and Range and in nearby hilly areas, recorded in gravel.

Flowering period. September-November.

33. **Pimelea sessilis** Rye, sp. nov. (Figure 51.)

Affinis *P. lehmannianae* Meissner sed differt foliis arcte sessilibus, involucri bracteis ellipticis ad subcircularibus et tubo florali fauce intus nudo.

Typus: 0.7 km S of Kalbarri — Ajana road on track to Meanarra Hill, Kalbarri National Park, Western Australia, 28 Sept. 1985, *N. Hoyle* 527 (holo: PERTH; iso: CANB, MEL).

Related to *P. lehmanniana* Meissner but differs in the closely sessile leaves, the broadly elliptic to almost circular involucral bracts and the absence of hairs inside the throat of the floral tube.

Shrub, erect, usually 0.15-0.4 m high, single-stemmed at ground level. *Stems* deep red-brown or yellowish near each inflorescence, becoming dark brown further from apex. *Leaves* usually patent, sessile, elliptic to almost circular, almost concolorous to definitely discolorous, medium green to dark bluish green on adaxial surface, paler on abaxial surface, variable in size, the larger leaves 8-15 x 6-9 mm and the smaller leaves 2-8 x 1-6 mm, somewhat 2-lobed and stem-clasping at base, the margin recurved, broadly obtuse but mucronulate at extreme apex. *Peduncle* usually 5-25 mm long. *Involucral bracts* 4, green with reddish or yellowish areas, broadly elliptic to almost circular, 7-15 x 6-14 mm, appressed-hairy inside, not ciliate. *Inflorescence* erect. *Pedicels* 1.5-2 mm long; hairs up to 2.5 mm long. *Flowers* bisexual or rarely female, white or cream, not circumscissile, glabrous inside; tube 8-11 mm long. *Ovary-portion of floral tube* c. 2 x 0.7 mm, usually with reflexed to retrorse minute hairs 0.2-0.4 mm long and sparse long hairs. *Style-portion of floral tube* 6.5-8.5 mm long, c. 0.7 mm diam. at summit, with long patent hairs 2-3.5 mm long but no small hairs in proximal half or for most of style-portion, with antrorse hairs c. 1 mm long in distal half or only at summit. *Sepals* narrowly ovate, 3-5 mm long, with hairs 1-3 mm long. *Stamens* exceeding sepals; filament 2.5-4 mm long; anther 0.7-1 x c. 0.4 mm; slits semi-lateral after dehiscence. *Style* exserted by 3-4.5 mm.

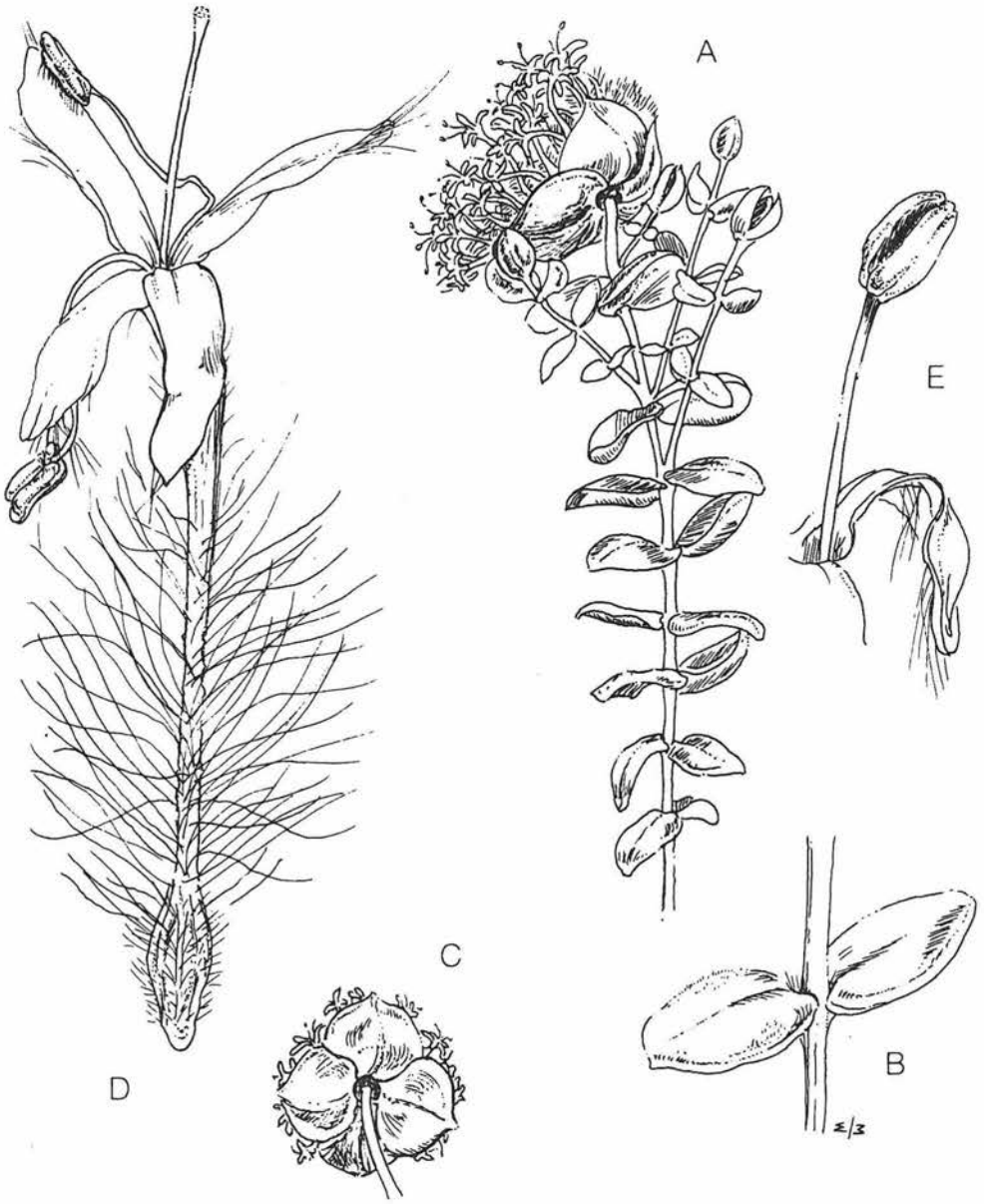

Figure 51. *Pimelea sessilis*. A- flowering stem; B- leaves (x 2); C- inflorescence from below; D- flower (x 10); E- stamen (x 16). Drawn from fresh material represented by *B. Bellairs* (near Kalbarri, 21 Aug. 1983).

Specimens examined. WESTERN AUSTRALIA: King George Sound, *C. Andrews* 825 (PERTH); Yandanooka, 1932, *A.M. Baird* (UWA); c. 1/2 mi [0.8 km] from Kalbarri, 21 Aug. 1983, *B. Bellairs* (PERTH); Mullewa Plains, Sept. 1931, *W. E. Blackall* (PERTH); Balla, Oct. 1964, *W. H. Butler* (PERTH); 5.7 mi [9 km] S of Geraldton-Mullewa road toward The Casuarinas, *E. M. Canning* 683140 (CBG); Murchison River, *A. J. Cough* 181 (PERTH); 0.5 mi [0.8 km] from Kalbarri on Ajana Rd, *A. R. Fairall* 1180 (PERTH); Mullewa Plains, *C. A. Gardner & W. E. Blackall* 709 (PERTH); Turnoff to Meanarra Hill, Kalbarri National Park, *R. J. Garraty* 518 (PERTH); NW Coastal Hwy, 28 mi [45 km] N of Murchison River,

A. S. George 1503 (PERTH); NW Coastal Hwy, 9 mi [14.5 km] N of Murchison River, *A.S. George* 7878 (PERTH); 4 mi [6.5 km] SE of Tamala Station, *A.S. George* 9573 (PERTH); NW Coastal Hwy, c. 42 km N of Murchison River, *E.N.S. Jackson* 3127 (AD); c. 20 km by road N of Whelarra, *E.N.S. Jackson* 3168 (AD); Shark Bay, 1877, *F. Mueller* (MEL); Murchison River Gorge, 27 Sept. 1962, *M.E. Phillips* (CBG); 13 mi [21 km] by road SE of Kalbarri, *R.V. Smith* 66/365 (MEL); Murchison River, 6 Sept. 1949, *N.H. Speck* (UWA); Hawks Head Lookout, Kalbarri National Park, *A.S. Weston* 6922 (PERTH).

Distribution. (Figure 55.) Extends from Tamala Station (26°44' S, 113°43' E) south-east to Yandanooka (29°19' S, 115°34' E).

Habitat. Occurs in sand in shrublands.

Flowering period. August-October.

Derivation of name. Sessilis (L.) — sessile, referring to the leaves.

Affinities. Closest to *Pimelea lehmanniana*, also similar to *P. leucantha*.

Notes. Of 11 collections examined in PERTH, one was from a female plant and the remainder from bisexual plants.

34. **Pimelea rara** Rye, Nuytsia 5: 9-10 (1984). — *Pimelea lehmanniana* var. *ligustrinoides* Benth., Fl. Austral. 6: 9 (1873). *Type:* Swan River (Western Australia), date unknown, *J. Drummond*, coll. 1 (lecto, fide Rye loc. cit.: K; isolecto: K, NY).

Shrub, erect or decumbent, 0.2-0.35 m high, single- or multi-stemmed at ground level, with few branches above. *Stems* somewhat reddish near each inflorescence, becoming dark brown to black further from apex. *Leaves* antrorse to patent; petiole c. 1 mm long; lamina concolorous, dull bluish green, elliptic or obovate, 15-30 x c. 8 mm, flat, obtuse or almost acute. *Peduncle* 2-20 mm long. *Involucral bracts* 4, broadly ovate, 9-20 x c. 10 mm; outer bracts glabrous; inner bracts sparsely hairy inside, often with a few cilia, the cilia 0.5-1 mm long. *Inflorescence* erect. *Pedicels* c. 0.6 mm long, with hairs 1-2 mm long. *Flowers* bisexual, white, not circumscissile, glabrous inside or with a few hairs c. 0.5 mm long in a ring at throat of tube; tube c. 9 mm long. *Ovary-portion of floral tube* c. 3 x 1 mm, covered by reflexed hairs c. 0.5 mm long. *Style-portion of floral tube* c. 6 mm long, c. 1 mm diam. at summit, reflexed-hairy at base, with a band of patent hairs 2.5-3 mm long, usually mixed with short hairs similar to those on the ovary-portion or longer and more spreading and often with antrorse hairs c. 1 mm long at summit. *Sepals* ovate, 3-4 mm long, the outside sparsely covered by hairs 0.5-1 mm long, glabrous inside. *Stamens* greatly exceeding sepals; filament 4-5 mm long; anther 1.2-1.5 x c. 0.5mm; slits semi-lateral after dehiscence. *Style* exerted by up to 7 mm. (Figure — Rye 1984: 9.)

Specimens examined. WESTERN AUSTRALIA: between Parkerville and "Smith's Mill [Glen Forrest], Jan. 1904, *W.V. Fitzgerald* (NSW); Parkerville, *W.A. Ross* 435 (PERTH).

Distribution. (Figure 56.) Extends from near Parkerville (31°53' S. 116°08' E) south to near the Perth Observatory.

Habitat. Occurs on the Darling Range, recorded in lateritic soil in Jarrah forest.

Flowering period. December-January.

Conservation status. This species appears to be very rare and geographically restricted. Until recently there were only three known collections, two from the vicinity of Parkerville and one of unknown origin, the most recent collection having been made in 1919. Now a small population has been recorded further south.

Affinities. Probably closest to *Pimelea lehmanniana,* perhaps also close to *P. lanata.*

Figure 52. *Pimelea spectabilis.* A- flowering stem; B- inner surface of bract (x 3); C- flower (x 6); D- stamen (x 10). Drawn from fresh material represented by *N. Cohen* 1010.

Notes. The summer flowering time of *Pimelea rara* is unusual and may partially account for the small number of collections of the species.

35. **Pimelea spectabilis** Lindley, Sketch Veg. Swan R. 41 (1840). — *Heterolaena spectabilis* (Lindley) Fischer & C. Meyer, Index Sem. Hort. Petrop. 10: 48 (1845). — *Banksia spectabilis* (Lindley) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* south-western Australia, 1839, *J. Drummond* coll. 1 (lecto here designated: CGE); south-western Australia, date unknown, *J. Mangles* (syn: CGE).

Shrub, erect, usually 0.5-2 mm high, single-stemmed at ground level. *Stems* pale yellowish green or brown near each inflorescence, becoming dark red-brown to black further from apex. *Leaves* antrorse to patent; petiole 0.5-1.5 mm long; lamina discolorous, medium to dark green and often bluish on adaxial surface, paler green on abaxial surface, very narrowly elliptic, 11-42 x 2-7 mm or often broader in leaves shortly below each inflorescence, flat, acute, mucronate. *Peduncle* 2-15 mm long. *Involucral bracts* 4 or 6, green and partially reddish or largely reddish, ovate, 16-30 x 9-20 mm, sometimes partially hairy inside; outermost bracts not ciliate; inner bracts sometimes ciliate, the cilia 2-3 mm long. *Inflorescence* erect or pendulous. *Pedicels* 1.5-2 mm long; hairs 1-2(-4) mm long. *Flowers* bisexual or very rarely female, white, pale pink or pale yellow, not circumscissile; tube 13-19 mm long, glabrous inside. *Ovary-portion of floral tube* 2-3.5 x c. 0.7 mm, with minute antrorse hairs c. 0.1 mm long. *Style-portion of floral tube* 10-15 mm long, 1.1-1.5 mm diam. at summit, with a mixture of long patent hairs 4-8 mm long and minute hairs 0.1-0.2(-0.3) mm long in proximal half and with antrorse hairs 0.5-1 mm long in distal half. *Sepals* narrowly ovate or ovate, 4-6 mm long, with short hairs and a few long hairs outside, the longest hairs 1.5-3 mm long, appressed-hairy throughout or at base inside, the hairs up to 1 mm long. *Stamens* exceeding sepals, often greatly; filament 4-7 mm long; anther 1.2-1.5 x c. 0.2 mm; slits semi-lateral to lateral after dehiscence. *Style* exserted by 7-10 mm. Bunjong. (Figure 52.)

Specimens examined. WESTERN AUSTRALIA (selected from over 90 seen): 36 mi [57 km] N of Pemberton on road to Nannup, *J.C. Anway* 564 (AD, MEL, PERTH); Albany, *A. Ashby* 23 (PERTH); near Augusta, *A.M. Ashby* 2695 (AD); SW of Shannon on road to Northcliffe, *A.M. Ashby* 3104 (AD, PERTH); near Mt Dale, *M.G. Corrick* 7838 (MEL); 34 mi peg [54.5 km], Brookton Hwy, *H. Demarz* 443 (PERTH); Northcliffe, *A.R. Fairall* 859 (PERTH); Nornalup Inlet, *C.A. Gardner* 13026 (PERTH); Thumb Peak Range, *A.S. George* 7116 (PERTH); Shannon River, c. 25 km due E of Northcliffe, *T.A. Halliday* 283 (AD, CANB, PERTH); East Mt Barren, *T.B. Muir* 4165 (MEL); Albany Hwy, 35 mi [56 km] S of Perth, *S. Paust* 1069 (PERTH); 2 mi [3 km] E of Canning Dam, 16 Oct. 1962, *M. Phillips* (CBG); Metricup, *R.D. Royce* 4685 ((PERTH); Fitzgerald River National Park, *R.D. Royce* 9259 (PERTH); upper Helena Valley, *J. Seabrook* 398 (CANB, PERTH); between Cowaramup and Margaret River, *D. J. E. Whibley* 5045 (AD, PERTH); Denmark, *C. T. White* 5365, (BRI); 4.5 mi [7 km] from Denmark towards Mount Barker, 13 Oct. 1968, *J. Wrigley* (AD, CBG).

Distribution. (Figure 57.) Extends from Mundaring (31°54' S, 116°10' E) and possibly further north in the Darling Range south to near Jarrahdale (c. 32°50' S and 116°13' E) and from Cape Naturaliste (33°32' S, 115°01' E) south-east to Albany (35°02' S, 117°53' E). Also occurs in Fitzgerald River National Park near Thumb Peak (34°02' S, 119°43' E) and on East Mt Barren (33°55' S, 120°01' E).

Habitat. In the Darling Range and extreme south-west of Western Australia, recorded mainly in sand with gravel or lateritic rocks, in Jarrah forest, sometimes with Marri or Karri trees as well as the Jarrah. In Fitzgerald River National Park, occurs on the upper rocky slopes and summits of hills, recorded in low shrubland with outcropping quartzite.

Flowering period. Mainly September-November.

Affinities. Closest to *Pimelea lehmanniana.*

Notes. Specimens from the northern part of the species range, from Mundaring to Jarrahdale, tend to have erect to spreading inflorescences without cilia on the involucral bracts, white to pink flowers with the longest hairs usually 4-6 mm long, stamens shortly exceeding the sepals and the style exserted by 7-8mm. Specimens from the south-eastern part of the range, especially in Fitzgerald River National Park, have pendulous inflorescences with the inner bracts usually ciliate, pale yellow flowers with the longest hairs 6-8 mm long, stamens greatly exceeding the sepals and the style exserted usually by 9-10mm. Specimens from intermediate areas show combinations of the character states listed for the extremes of the species range.

Figure 53. *Pimelea leucantha.* A- flowering stem, with leaves as in fresh state; B- leaf (x 4); C- inner surface of bract (x 4); D- flower (x 7). Drawn from *H. Demarz* 3943 (A, C) and *F. Lullfitz* 4394 (B, D).

More study, including field work, is needed to determine whether infraspecific taxa should be recognised in this species. Two varietal names given in the list of nomina dubia, *P. spectabilis* var. *distans* Benth. and *P. spectabilis* var. *verschaffeltii* (Morren) Meissner, may be applicable to the southern variant of *P. spectabilis.*

36. **Pimelea leucantha** Diels in Diels & E. Pritzel, Bot. Jahrb. Syst. 35: 393 (1904). *Type:* Greenough River, Western Australia, 10 Sept. 1901, *L. Diels* 4238 (iso: PERTH).

Pimelea rosea var. *calocephala* Meissner in Lehm., Pl. Preiss. 1: 602-603 (1845). *Type:* "near Lake Keiermulu" [Leederville area], Perth, Western Australia, 4 Oct. 1839, *L. Preiss* 1267 lecto here designated: LD; isolecto: MEL, NY).

Shrub, erect, 0.4-2 m high, single-stemmed at ground level. *Stems* pale brown or red-brown near each inflorescence, becoming dark grey to black further from apex. *Leaves* antrorse to patent; petiole 0.5-1.2 mm long; lamina slightly to distinctly discolorous, medium green then becoming bluish green on adaxial surface, paler on abaxial surface, narrowly ovate-elliptic or very rarely ovate but often appearing linear when dried and laterally revolute, 8-27 x 1.5-6.5 mm, with margins recurved at first and becoming (at least when dried) revolute, obtuse or acute. *Peduncle* 1-6 mm long. *Involucral bracts* 4 or rarely 6, medium green or yellowish green and commonly pink-tinged, ovate, 14-24 x 6-14 mm; outer bracts and medial bracts (when present) glabrous or with fewer cilia than inner pair of bracts; inner bracts glabrous or subglabrous inside, sometimes ciliate, the cilia up to 4 mm long. *Inflorescence* erect to pendulous. *Pedicels* 1-1.5 mm long; hairs up to 3 mm long. *Flowers* bisexual, pale yellow or cream, not circumscissile, glabrous inside; tube 12-18 mm long. *Ovary-portion of floral tube* 2-2.5 x 0.7-1 mm, with minute antrorse to patent hairs 0.1-0.3 mm long, sometimes with a few long hairs at summit. *Style-portion of floral tube* 9-15mm long, c. 1 mm diam. at summit, with a mixture of long patent hairs 3-4.5 mm long and minute hairs 0.2-0.4mm long in proximal half, with shorter antrorse hairs mostly 0.5-1 mm long in distal part. *Sepals* ovate or narrowly ovate, 3-5.5 mm long, with short hairs and a few long hairs, the longest hairs 1-2.5 mm long. *Stamens* usually shorter than sepals; filament 1.5-2.5 mm long; anther 0.9-1.3 x c. 0.3 mm; slits semi-lateral to lateral after dehiscence. *Style* exserted by 2.5-4 mm. (Figure 53.)

Specimens examined. WESTERN AUSTRALIA (selected from over 35 seen): S of Red Bluff, *A.M. Ashby* 1825 (AD); Murchison House Station, *J.S. Beard* 6882 (PERTH); Perry Rd, E of Yanchep, *J. Havel* 94 (PERTH); 8 km S of Eneabba, *R. Hnatiuk* 771518 (PERTH); Lake Banganup area, *B.R. Maslin* 1351 (PERTH); Subiaco, 17 Oct. 1908, *A. Morrison* (CANB, EDIN); 5 mi [8 km] W of Indarra, *K. Newbey* 2162 (PERTH); 13 mi [21 km] from Walkaway towards Strawberry, 15 Sept. 1968, *M.E. Phillips* (AD, BRI, CBG); Watheroo National Park, *R.D. Royce* 9569 (PERTH); Kingsway Rd, S of Wanneroo, *H. Salasoo* 4129 (NSW).

Distribution. (Figure 56.) Extends from Kalbarri National Park (27°40' S, 114°15' E) south to near Lake Banganup (32°10' S, 115°49' E).

Habitat. In Kalbarri National Park, occurs in sand with exposed or outcropping sandstone or limestone. Elsewhere generally recorded in deep sand.

Flowering period. Mainly August-October.

Affinities. Closest to *Pimelea spectabilis, P. ciliata* and *P. avonensis.*

37. **Pimelea avonensis** Rye, sp. nov. (Figure 54.)

Affinis *P. ciliatae* Rye sed differt bracteis involucralibus exterioribus non ciliatis, bracteis interioribus plerumque intus pilosis et staminum filamentis brevioribus.

Typus: Fowlers Gully, Wongan Hills, Western Australia, 14 Sept. 1983, *K.F. Kenneally* 8808 (holo: PERTH; iso: CANB, K, MEL).

Related to *P. ciliata* Rye but differs in the non-ciliate outer involucral bracts, in the inner bracts commonly being hairy inside and in the shorter stamen filaments.

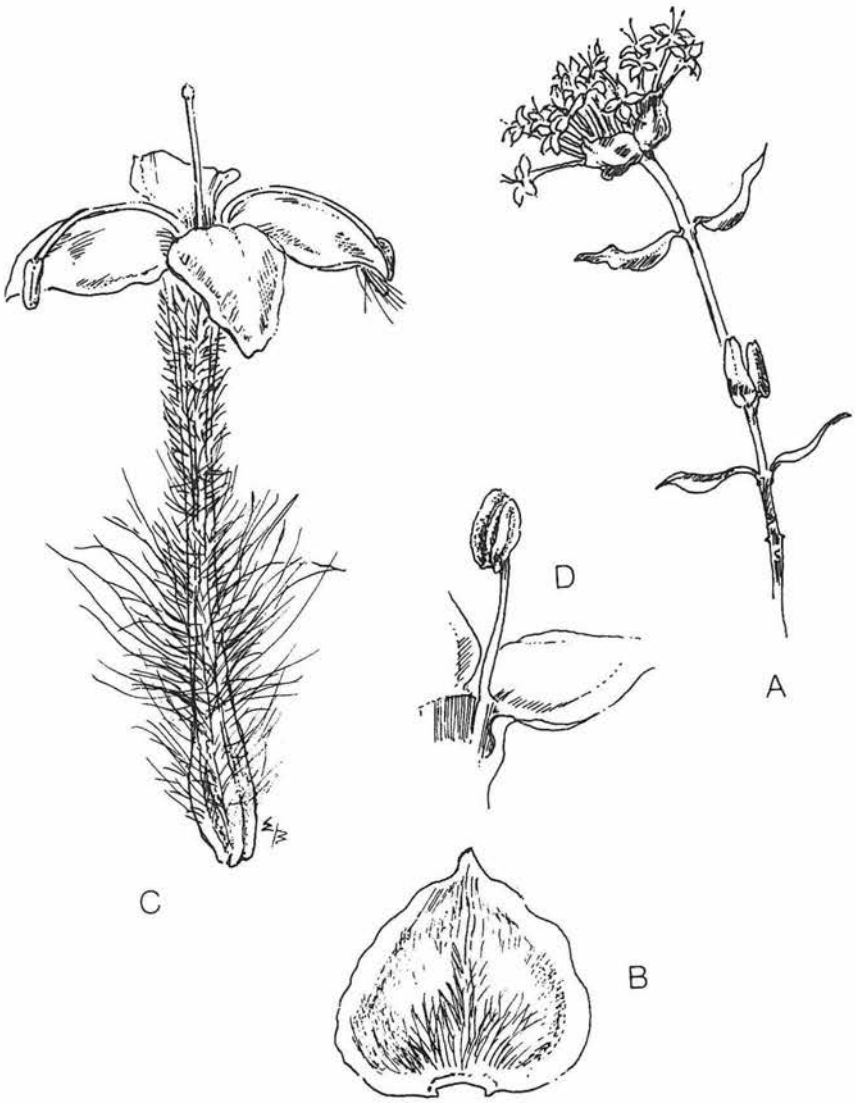

Figure 54. *Pimelea avonensis.* A- flowering stem; B- inner surface of inner bract (x 4); C- flower (x 8); D- stamen (x 10). Drawn from fresh material represented by the type collection, *K.F. Kenneally* 8808.

Shrub, erect, usually 0.4-1 m high, single-stemmed at ground level. *Stems* red-brown near each inflorescence, becoming medium grey further from apex. *Leaves* patent or sometimes antrorse; petiole 0.2-1 mm long; lamina discolorous, medium to dark green and often becoming dark bluish green on adaxial surface, paler green on abaxial surface, narrowly ovate-elliptic or linear, 5-24 x 0.5-3 mm, with margins recurved and becoming (at least when dried) revolute, the apex inconspicuously mucronulate and recurved. *Peduncle* 2-22 mm long. *Involucral bracts* 4 or 6, green or yellowish green and often red-tinged, 7-13 x 3.5-9 mm; outer bracts narrowly ovate to ovate, glabrous; inner bracts (and medial bracts when present) ovate or broadly ovate, often appressed-hairy inside, very rarely with a few cilia, the cilia up to 1.7 mm long. *Inflorescence* erect. *Pedicels* c. 1 mm long; hairs up to 1.5 mm long. *Flowers* bisexual, white at maturity but often pink in bud, not circumscissile, glabrous inside; tube 8-12 mm long. *Ovary-portion of floral tube* 2-2.5 x c. 1.1 mm, with short patent hairs 0.2-0.4 mm long, often with a few long hairs towards summit. *Style-portion of floral tube* 6-9 mm long, 0.7-1 mm diam. at summit, with a mixture of long patent hairs 1.5-2(-3) mm long and short patent hairs 0.1-0.3(-0.5) mm long in proximal part or throughout, the distal part often with antrorse hairs 0.5-1 mm long. *Sepals* ovate, 2-4 mm long, with short hairs and a few longer hairs 1-1.5 mm long. *Stamens* shorter than to slightly exceeding sepals; filament 1.5-2.5 mm long; anther 0.6-1.1 x c. 0.2 mm; slits semi-lateral to lateral after dehiscence. *Style* exserted by 1.5-4 mm.

Specimens examined. WESTERN AUSTRALIA (selected from over 55 seen): Wilroy, *A.M. Ashby* 1806 (AD, PERTH); between Coorow and Arrino, *W.E. Blackall* 2611 (PERTH); Tardun, 26 Aug. 1948, *J.B. Cleland* (AD); Kalannie, *C.F. Davies* 282 (PERTH); Dalwallinu, *A.L. Fairall* 1041 (PERTH); Korrelocking, *C.A. Gardner* 681 (PERTH); Mt Singleton, *C.A. Gardner* 2211 (PERTH); Wongan Hills, *E.H. Ising* 83 (AD); Entrance to Fowlers Gully, Wongan Hills, *K.F. Kenneally* 1369 (MEL, PERTH); Cowcowing, *M. Koch* 1178 (MEL, PERTH); 2 mi [3 km] NNW of Buntine, *R. Melville* 4301B (MEL, PERTH); 7 mi [11 km] NE of Wongan Hills, *K. Newbey* 2001 (PERTH); c. 2 mi [3 km] W of Moorine Rock, *M.E. Phillips* 757 (BRI, CANB, CBG); 7 mi [11 km] NW of Trayning, *R.D. Royce* 461 (PERTH).

Distribution. (Figure 57.) Extends from Wilroy (28°38' S, 115°38' E) south-east to Moorine Rock (31°19' S, 119°03' E), with isolated records from near York (31°53' S, 116°46' E) and Dongolocking Reserve (34°04' S, 117°41' E).

Habitat. Recorded mainly in sand or sandy soils, often in open woodlands or shrublands.

Flowering period. July-October.

Derivation of name. The specific epithet refers to the Avon Botanical District, in which the species occurs.

Affinities. Closest to *Pimelea ciliata.* Also close to *P. brevifolia,* showing greatest similarity to subsp. *modesta,* and *P. brachyphylla.*

38. **Pimelea brevistyla** Rye, Nuytsia 5: 1-4 (1984). *Type:* Glenburn Rd, Glen Forrest, Western Australia, 31°55' S, 116°06' E, 6 Oct. 1983, *N. Cohen* 1002 (holo: PERTH; iso: CANB, K, MEL, NSW).

Shrub, erect, usually 0.3-1.3 m high, single-stemmed at ground level. *Stems* red-brown near each inflorescence, becoming grey further from apex. *Leaves* usually widely antrorse to patent; petiole 0.5-1.5 mm long; lamina concolorous or slightly discolorous, medium green when young, becoming dark bluish green, usually narrowly ovate, 7-28 x 2-3.5 mm, adaxially concave or flat, tapering to a very narrow but obtuse apex, often slightly mucronulate, the margin recurved. *Peduncle* 0.5-5 mm long. *Involucral bracts* 2 or 4, usually pale green and partly

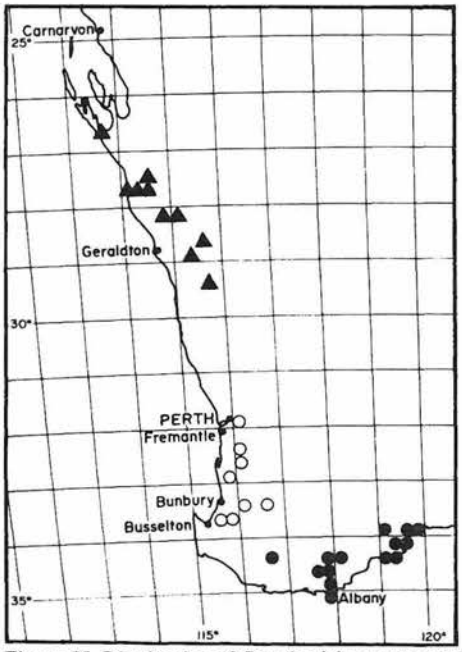

Figure 55. Distribution of *Pimelea lehmanniana* subsp. *lehmanniana* ●, *P. lehmanniana* subsp. *nervosa* ○ and *P. sessilis.* ▲

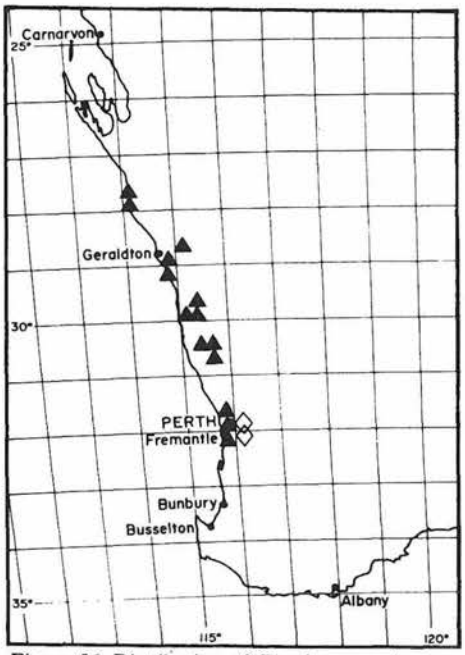

Figure 56. Distribution of *Pimelea rara* ♦ and *P. leucantha* ▲.

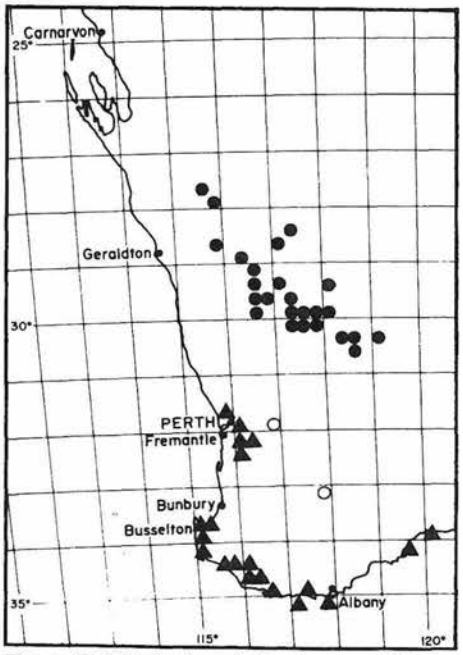

Figure 57. Distribution of *Pimelea spectabilis* ▲ and *P. avonensis* ●, ○ (isolated localities).

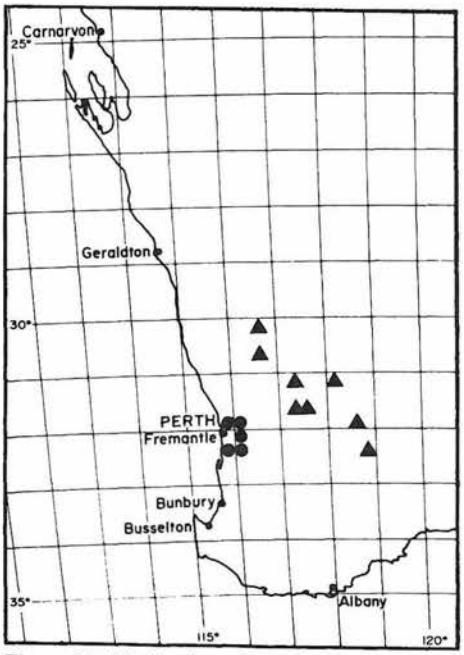

Figure 58. Distribution of *Pimelea brevistyla* subsp. *minor* ▲ and *P. brevistyla* subsp. *brevistyla* ●.

yellowish, 7-20 x 4-13 mm, acute or acuminate; outer bracts (when present) ovate or broadly ovate, glabrous or with a few cilia, often separated by a distinct internode from the inner pair of bracts; inner bracts broadly ovate-elliptic, much thinner than the leaves, appressed-hairy inside, glabrous or with a few hairs near base outside, densely ciliate, the largest cilia 1.5-3 mm long, the cilia around apex up to 1 mm long. *Inflorescence* erect. *Pedicels* c. 1 mm long; hairs 0.1-0.2 mm long. *Flowers* bisexual, not circumscissile; tube 8-15 mm long, glabrous inside. *Ovary-portion of floral tube* brown, 2-4 x c. 0.9 mm, appearing glabrous but usually sparsely covered by minute reflexed to patent hairs 0.1-0.2 mm long. *Style-portion of floral tube* 6-12 mm long, c. 1 mm diam. at summit, glabrous inside; proximal half brown, with minute hairs similar to those on the ovary-portion but 0.1-0.3 mm long and with patent hairs 2.5-5.5 mm long at least in distal part; distal half white, densely covered by antrorse hairs 0.2-1 mm long. *Sepals* white, ovate, 3-6 mm long, the outside with a similar indumentum to that of the distal part of floral tube but usually with a few larger hairs 1-2 mm long, the inside more sparsely appressed-hairy or glabrous, the hairs inside up to 0.4 mm long. *Stamens* subsessile at throat of floral tube; filament c. 0.25 mm long; anther 1-1.8 x c. 0.7 mm; slits strictly adaxial. *Style* not or scarcely exserted. (Figures 59 and Rye 1984: 3.)

Distribution. (Figure 58.) Occurs both in the Darling Range near Perth and in the central wheatbelt from Wubin to Hyden. The two areas are separated by over 130 km.

Flowering period. August-October.

Affinities. A very distinct species, somewhat intermediate between sect. *Calyptrostegia* and sect. *Heterolaena* but probably closest to *Pimelea ciliata* of the latter section. It is atypical of sect. *Heterolaena* in having subsessile, strictly introrse anthers, with the connective laterally exceeding the cells slightly, and in having cilia around the apex of the involucral bracts.

Notes. There are two allopatric subspecies, occurring in the Darling Range and wheatbelt respectively. The latter subspecies has smaller leaves, involucral bracts and flowers than the former, perhaps as a response to its less humid environment. A more significant difference, perhaps, is the tendency for the long hairs of the floral tube to be differently positioned in the two taxa.

Key to Subspecies

1. Involucral bracts 7-11 mm long. Floral tube 8-11 mm long. Sepals 3-4 mm long.....38a. subsp. *minor*
1. Involucral bracts 12-20 mm long. Floral tube 11-15 mm long. Sepals 4.5-6 mm long.....38b. subsp. *brevistyla*

38a. subsp **minor** Rye, subsp. nov. (Figure 59.)

Differt a *P. brevistyla* Rye subsp. *brevistyla* involucri bracteis floribus antheris brevioribus.

Typus: Great Eastern Hwy, 4.1 km W of Hines Hill, Western Australia, 31°33' S, 118°04' E, 27 Aug. 1983, *N. Cohen* 1025 (holo: PERTH; iso: CANB, K, MEL, NSW).

Differs from *P. brevistyla* Rye subsp. *brevistyla* in the shorter involucral bracts, flowers and anthers.

Shrub, usually 0.3-0.8 m high. *Leaves* 7-19 mm long or rarely shorter. *Involucral bracts* 7-11 x 4-9 mm. *Floral tube* 8-11 mm long. Style-portion of floral tube 6-8 mm long, with a band of long hairs extending from the base (or very near the base) upward, the longest hairs 2.5-3.5 mm long. *Sepals* 3-4 mm long. *Anthers* 1-1.2 mm long.

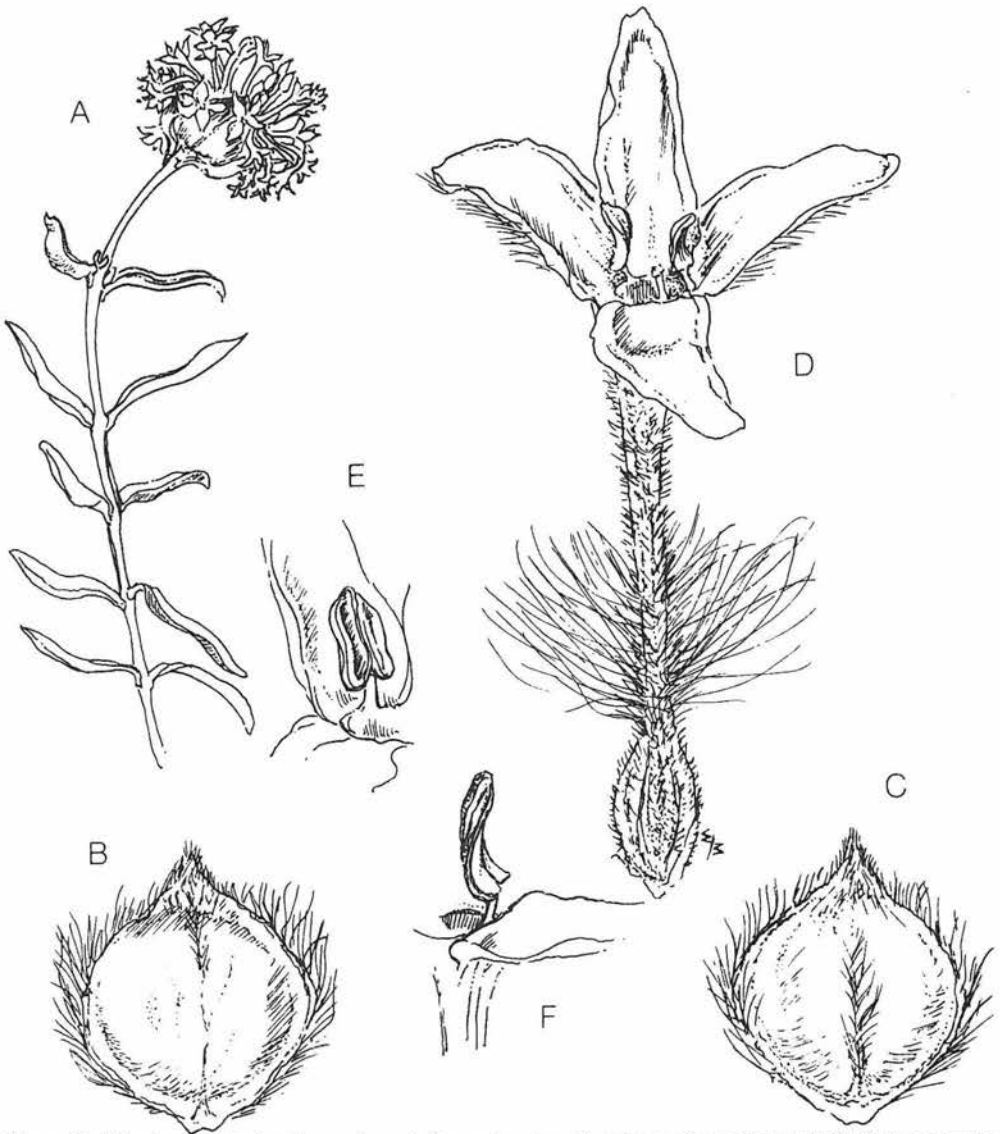

Figure 59. *Pimelea brevistyla* subsp. *minor*. A- flowering stem; B- outer surface of bract (x 3); C- inner surface of bract (x 3); D- flower (x 7); E- inner surface of anther (x 12); F- side view of anther (x 14). Drawn from fresh material represented by *N. Cohen* 1025.

Specimens examined. WESTERN AUSTRALIA: Muntadgin, *E.T. Bailey* 686 (PERTH); Wyalkatchem, Oct. 1937, *W.E. Blackall* (PERTH); Merredin, *M. Koch* 2772 (MEL); Merredin, *M. Koch* 2843 (MEL); Kellerberrin, Sept. 1897, *R.B. Leake* (PERTH); 13 mi [c. 21 km] NE of Hyden, *K. Newbey* 1090 (PERTH); 1 km from Wubin to Brinbro, *M.E. Phillips* 930 (CBG, PERTH); 1 mi [c. 1.6 km] S of Wubin, 2 Oct. 1962, *M.E. Phillips* (CBG); 5.3 mi [c. 8 km] S of Wubin, *M.E. Phillips* 2928 (CBG); 12 mi [c. 19 km] E of Ballidu, *R.D. Royce* 2132 (PERTH); Mt Caroline, 1890, *G. Sewell* (MEL); c. 50 km NNW of Merredin, *D.J.E. Whibley* 4726 (PERTH).

Distribution. (Figure 58.) Extends about 335 km from Wubin (30°07' S, 116°38' E) south-east to near Hyden (c. 32°48' S, 118°59' E).

Habitat. The habitat of the type locality was described as "red sandy clay over laterite on a flat road verge". No other collections give habitat details but two of the localities are possibly granite outcrops.

Flowering period. August-October.

Derivation of name. Minor (L.) — lesser, referring to the smaller size of the leaves, bracts and flowers.

38b. subsp. **brevistyla**

Shrub, usually 0.5-1.3 m high. *Leaves* 14-28 mm long. *Involucral bracts* 12-20 x 8-13 mm. *Floral tube* 11-15 mm long. Style-portion of floral tube 8-12 mm long, glabrous or with very short hairs in the proximal 0-2 mm, with a band of long hairs above, the longest hairs 3-5.5 mm long. *Sepals* 4.5-6 mm long. *Anthers* 1.5-1.8 mm long. (Figure — Rye 1984: 3.)

Specimens examined. WESTERN AUSTRALIA: "Smith's Mill" [Glen Forrest], Sept. 1901, *L. Diels & E. Pritzel* (PERTH); Karragullen, *A.R. Fairall* 319A (PERTH); Serpentine Falls, *J.W. Green* 361 (PERTH); Serpentine, Sept. 1922, *G.E. Perrin* (MEL); Darling Range, Sept. 1901, *E. Pritzel* (PERTH); Glen Forrest, *B.L. Rye* 82009 (PERTH); Helena Valley, *J. Seabrook* 584 (PERTH).

Distribution. (Figure 58.) Restricted to the Darling Range. Extends from Glen Forrest (31°54' S, 116°06' E) south to Serpentine Falls (32°22' S, 116°01' E).

Habitat. Usually occurs on hillsides with clay soil and granite rocks. Also recorded in gravelly sand.

Flowering period. August-October.

39. **Pimelea ciliata** Rye, Nuytsia 5: 6-9 (1984). *Type:* Glenburn Rd, Glen Forrest, Western Australia, 31°55' S, 116°06' E, 6 Oct. 1983, *N. Cohen* 1001 (holo: PERTH; iso: CANB, K, MEL, NSW).

Shrub, erect, usually 0.5-1 m high, single-stemmed at ground level, many-branched and often bushy above. *Stems* red-brown or orange-brown near each inflorescence, becoming dark grey further from apex. *Leaves* usually widely antrorse to patent; petiole 0.2-1 mm long; lamina discolorous, medium green to dark bluish green on adaxial surface, pale green on abaxial surface, usually ovate to narrowly obovate or narrowly oblong (often appearing linear when margins become revolute on drying), usually 5-22 x 1.5-7 mm, tapering to base, the margins recurved or somewhat revolute; apex acute, mucronulate, often recurved. *Peduncle* 1-10(-15) mm long. *Involucral bracts* 4 or 6, usually green with a pinkish base, sometimes largely reddish, ovate or broadly ovate, 8-13 x 5-10 mm, ciliate, otherwise glabrous or with hairs at base and rarely also at centre inside; cilia up to 2.5 mm long. *Inflorescence* erect. *Pedicels* 1-2 mm long; hairs 1-3.5 mm long. *Flowers* bisexual or very rarely female, white or pale pink, not circumscissile, glabrous inside; tube 8-14 mm long. *Ovary-portion of floral tube* with numerous patent hairs 0.1-0.2 mm long, very rarely with a few long hairs in distal part. *Style-portion of floral tube* 5.5-12 mm long, c. 1.5 mm diam. at summit; proximal half with patent hairs 2.5-5 mm long nearly always mixed with at least a few minute hairs similar to those on the ovary-portion but 0.1-0.3 mm long; distal half covered by very fine antrorse hairs mostly 0.3-1 mm long. *Sepals* ovate or narrowly ovate, 2.5-5.5 mm long, the outside with similar hairs to those on the distal part of the floral tube mixed with a few large hairs, the longest hairs 1-2.5 mm long. *Stamens* slightly to greatly exceeding sepals; filament 3.25-5.5 mm long; anther 0.75-1.5 x c. 0.3 mm; slits semi-lateral to lateral after dehiscence. *Style* exserted by 3-6 mm. (Figure 60.)

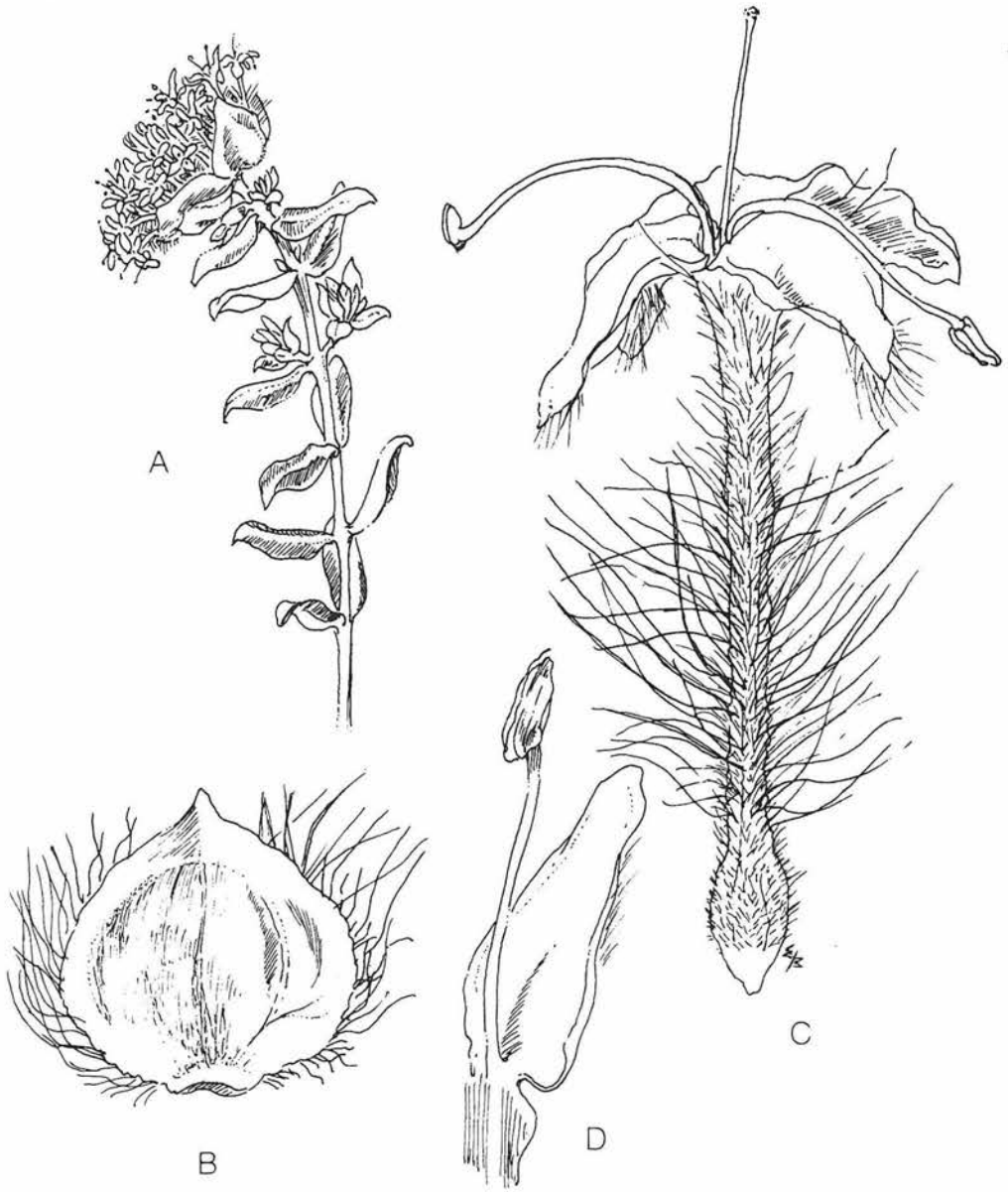

Figure 60. *Pimelea ciliata* subsp. *ciliata*. A- flowering stem; B- inner surface of bract (x 4); C- flower (x 10); D- stamen (x 15). Drawn from fresh material represented by *K. Newbey* 9847.

Distribution. (Figure 63.) Extends from north of Bindoon south to near Margaret River and south-east to near the Porongurup Range.

Flowering period. August-December.

Affinities. Closest to *Pimelea rosea* and *P. avonensis.*

Notes. Two allopatric subspecies are recognised but the variation within subsp. *ciliata* needs to be investigated further.

Key to Subspecies

1. Leaves recurved at apex. Flowers white or very rarely pale pink. Floral tube 8-12 mm long.....39a. subsp. *ciliata*
1. Leaves not or scarcely recurved at apex. Flowers pale pink. Floral tube 12-14 mm long.....39b. subsp. *longituba*

39a. subsp. **ciliata**

Leaves: lamina narrowly oblong to elliptic or broadest above or below the middle within the same length/width ratios, usually 5-22 x 1.5-7 mm, recurved at apex. *Involucral bracts:* largest cilia 2-2.5 mm long. *Flowers* white or very rarely pale pink. *Floral tube* 8-12 mm long; style-portion 5.5-9 mm long. *Sepals* 3-5.5 mm long. *Stamens* shortly to greatly exceeding sepals. (Figure 60.)

Specimens examined. WESTERN AUSTRALIA (selected from over 110 seen): Manjimup, *H.J. Anderson* 28 (PERTH); 42 mi [68 km] Perth to Toodyay, *E.M. Canning* 2808 (CBG); Pickering Brook, 13 Nov. 1928, *E. Dell* (PERTH); Helena Valley, *H. Demarz* 1724 (CANB); Bickley Reservoir, *H. Demarz* 6199 (PERTH); Wagin, *T.E. George* 191 (MEL); Mount Barker, *T.E. George* 561 (MEL); Wooroloo, *M. Koch* 1424 (MEL); Manjimup, *M. Koch* 2455 (MEL); Kelmscott, 11 Sept. 1897, *A. Morrison* (BRI, CANB); Darlington, 6 Oct. 1910, *A. Morrison* (BRI); 2 mi [3 km] E of Kojonup, *K. Newbey* 1303 (PERTH); 5 mi [8 km] W of Darkan, *M.E. Phillips* 4005 (AD, CBG); near Lesmurdie, *J. Pulley* 1346 (CBG); Glen Forrest, *B.L. Rye* 82010 (PERTH); Mundaring Weir, 1936, *J. Scott* (NSW); Rocky Pool, Sept. 1929, *A. Steffanoni* (ADW); Stirling Range, *F.W. Went* 154 (PERTH); Manjimup to Nannup, *D.J.E. Whibley* 3242 (AD, NT); near Porongurup Range, *P.G. Wilson* 3369 (AD, CBG, PERTH); Collie River, *P.G. Wilson* 3761 (PERTH).

Distribution. (Figure 63.) Extends from north of Bindoon (c. 31°50' S, 116°10' E) south to Manjimup (34°15' S, 116°09' E) and south-east to near the Porongurup Range (c. 34°44' S, 117°55' E).
Habitat. Recorded from heavy soils in lateritic or granitic areas, usually on hills.

Flowering period. August-November.

Notes. A variant in the Manjimup area is atypical in having the long hairs of the floral tube extending down onto the ovary-portion and often having few or no short hairs mixed with the long hairs in the lower part of the style-portion.

39b. subsp. **longituba** Rye, subsp. nov.

Differt a *P. ciliata* Rye subsp. *ciliata* apice foliorum magis erecta, ciliis involucri bractearum brevioribus, tubo florali longiore.

Typus: Jindong, S of Busselton, Western Australia, 20 Oct. 1950, *R.D. Royce* 3402; holo: PERTH; iso: CANB, MEL.

Differs from *P. ciliata* Rye subsp. *ciliata* in the more erect leaf apex, the shorter cilia on the involucral bracts and the longer floral tube.

Leaves: lamina narrowly obovate to narrowly ovate, usually 8-13 x 1.5-5 mm, not or scarcely recurved at apex. *Involucral bracts:* largest cilia 1.5-2 mm long. *Flowers* pale pink. *Floral tube* 12-14 mm long; style-portion 8.5-12 mm long. *Sepals* 2.5-3.5 mm long. *Stamens* shortly exceeding sepals.

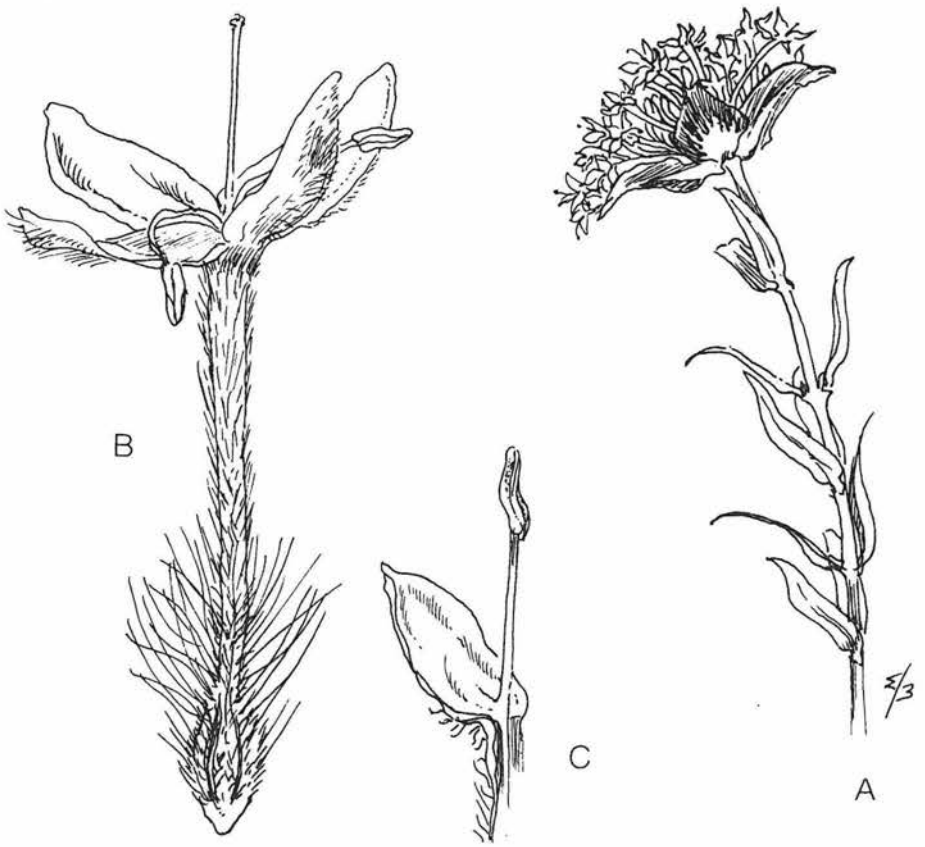

Figure 61. *Pimelea rosea.* A- flowering stem; B- flower (x 6); C- stamen (x 10). Drawn from fresh cultivated material represented by *B.L. Rye* 83001.

Specimens examined. WESTERN AUSTRALIA: Geographe Bay, *Irvine* (MEL 102505, 102541); Geographe Bay, 1896, *A. Pries* (MEL); near Bramley, *R. Pullen* 9870 (CANB); Jindong, *R.D. Royce* 2484 (PERTH); Cowaramup to Margaret River, *D.J.E. Whibley* 5044 (AD, PERTH); Yallingup, date unknown, *S.A. White* (AD).

Distribution. (Figure 63.) Extends from Yallingup (33°39' S, 115°02' E) south to Bramley (33°54' S, 115°05' E) and east to Ambergate (33°42' S, 115°20' E).

Habitat. Recorded in "red loamy soil". Probably occurs in clayey soils.

Flowering period. October-December.

Derivation of name. Longus (L.) — long, *tubus* (L.) — pipe, referring to the long floral tube.

Notes. Pimelea ciliata subsp. *longituba* and *P. rosea* occur close together and may sometimes be sympatric, although on the whole they appear to be separated by habitat differences, *P. rosea* occurring in sand and *P. ciliata* in heavier soils. *Pimelea rosea* can be distinguished by its less compact growth form, softer leaves, deep pink flower colour, shorter floral tube, presence of long hairs on the ovary-portion of the floral tube, slightly shorter stamens, which do not exceed the sepals, and less ciliate bracts.

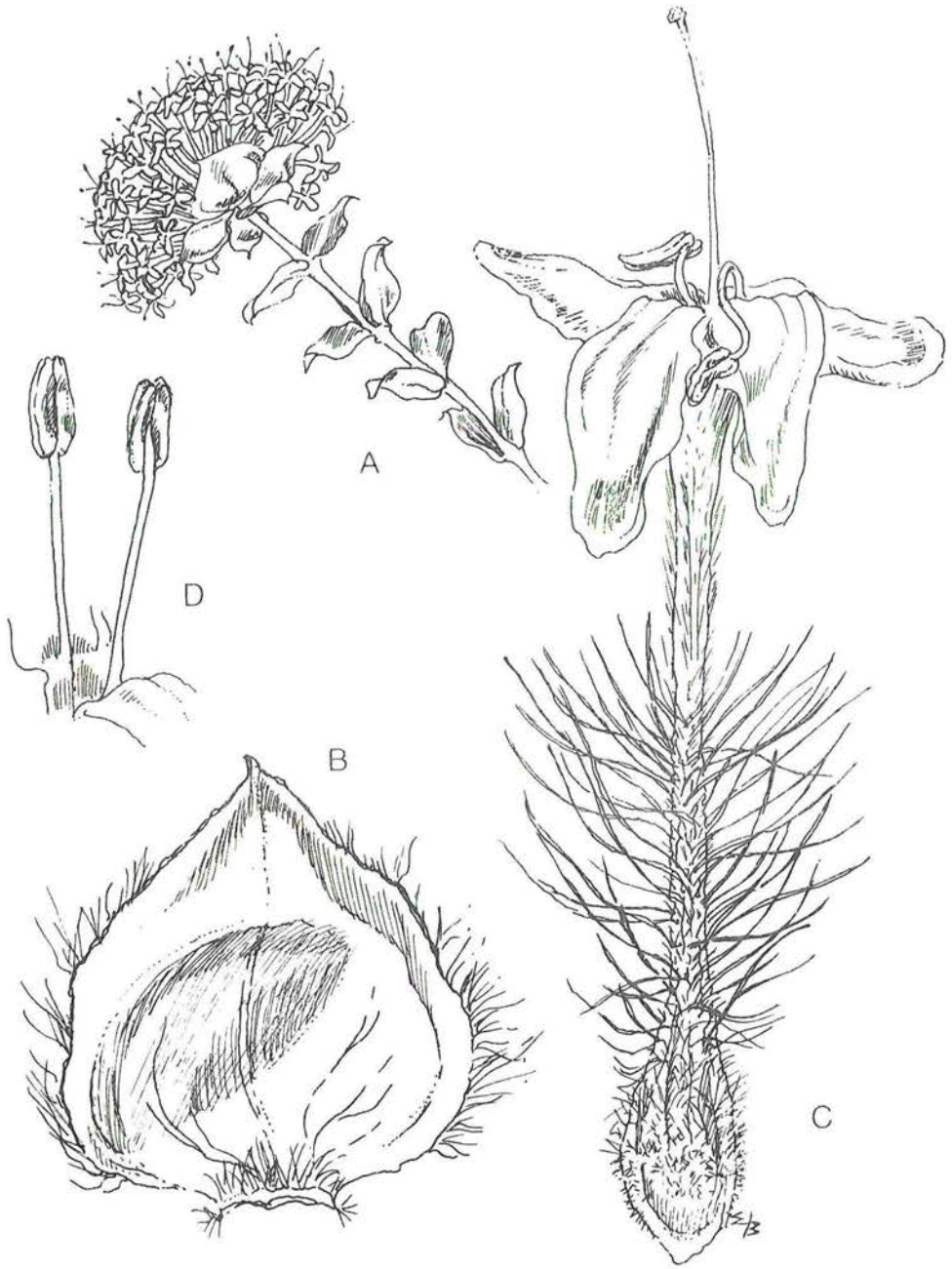

Figure 62. *Pimelea ferruginea*. A- flowering stem; B- inner surface of bract (x 7); C- flower (x 13); D- stamens (x 15). Drawn from fresh material collected from the Busselton area.

40. **Pimelea rosea** R. Br., Prodr. 360 (1810). — *Heterolaena rosea* (R. Br.) C. Meyer, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 73 (1845). — *Banksia rosea* (R. Br.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* King George Sound, Western Australia, Dec. 1801, *R. Brown* (BM).

Shrub, erect, 0.3-1 m high, single-stemmed at ground level. *Stems* dark red-brown near each inflorescence, becoming grey-brown further from apex. *Leaves* usually widely antrorse or patent; petiole usually 0.3-1 mm long; lamina discolorous, medium green and often becoming bluish green on adaxial surface, paler green on abaxial surface, narrowly elliptic, 6-30 x 1.5-5 mm, with flat or recurved margins, acute, mucronulate and recurved at apex. *Peduncle* 4-35 mm long. *Involucral bracts* 4, green with a yellowish to reddish base, ovate, 8-19 x 6-10.5 mm, acute to shortly acuminate; outer pair glabrous or with a few cilia towards base; inner pair ciliate, otherwise glabrous, the cilia 1-2 mm long. *Inflorescence* erect. *Pedicels* 0.7-1.5 mm long; hairs 1-2 mm long. *Flowers* bisexual, pale pink to deep red-purple, usually rose pink, not circumscissile, glabrous inside; tube 9.5-15 mm long. *Ovary-portion of floral tube* 2.5-3 x c. 1.5 mm, with numerous short hairs throughout, mixed in the distal part with long hairs similar to those on the style-portion above; short hairs patent to antrorse, up to 0.5 mm long. *Style-portion of floral tube* (7-)8-10(-12) mm long, 0.7-1 mm diam. at summit, with a mixture of long hairs and minute hairs in proximal part (usually the basal third) and short hairs in distal part; long hairs patent or widely antrorse, 2-3 mm long; minute hairs 0.1-0.3 mm long; short hairs of distal part antrorse, usually 0.3-1 mm long, very fine. *Sepals* ovate or sometimes narrowly ovate, 2.5-4 mm long, with hairs similar to those of the upper floral tube and some larger hairs c. 2 mm long. *Stamens* usually distinctly shorter than sepals; filament 0.7-2 mm long; anther 0.8-1.5 x c. 0.3 mm; slits semi-lateral to lateral after dehiscence. *Style* exserted by 1.5-4 mm. Rose Banjine. (Figure 61.)

Specimens examined. WESTERN AUSTRALIA (selected from over 140 seen): William Bay, *J.C. Anway* 249 (PERTH); Cape Naturaliste, *T.E.H. Aplin* 6486 (PERTH); Napier River, near Albany, *E.M. Bennett* 1048 (AD, PERTH); Emu Point Reserve, Albany, *E.M. Bennett* 1995 (PERTH); near Hay River, *S.T. Blake* 20932 (BRI); Erindale Rd, Warick, Nov. 1979, *P. Bridgewater* (PERTH); S of Yallingup, *N.T. Burbidge* 396 (CANB); Point Peron, *N.T. Burbidge* 1993 (CANB); Porongurup Range, *A.B. Cashmore* 67 (PERTH); Parry Inlet, *C.A. Gardner* 13038 (PERTH); near Windy Harbour, *C.H. Gittins* 1743 (BRI, NSW); 6 mi [9.5 km] SW of Walpole, *J.W. Green* 882 (PERTH); Naenup Swamp, c. 20 km SW of Pemberton, *T.A. Halliday* 267 (AD, CANB, PERTH); W of Lake Pinjar, *J. Havel* 107 (PERTH); North Fremantle, 11 Sept. 1897, *R. Helms* (PERTH); Point D'Entrecasteaux, *N.G. Marchant* 73102 (PERTH); Cape Leeuwin, 6 Nov. 1972, *E.C. Nelson* (CANB); Two Peoples Bay, *S. Paust* 435 (PERTH); Yalgorup National Park, *S. Paust* 1413 (PERTH); 26 mi [41.5 km] N of Bunbury, 21 Oct. 1962, *M.E. Phillips* (CBG); Yoongarillup, *R.D. Royce* 3888 (PERTH); Kudardup, *R.D. Royce* 3919 (PERTH); Warren River, *F.M.C. Schock* 68 (PERTH); Mt Clarence, Albany, *C.T. White* 5362 (BRI); Nedlands, *M.E. Wood* 1934 (PERTH); Elleker, 12 Oct. 1968, *J.W. Wrigley* (CBG).

Distribution. (Figure 64.) Extends around the coast from west of Lake Pinjar (c. 31°35' S, 115°40' E) to Mt Manypeaks (34°54' S, 118°16' E). Also one collection recorded from the Porongurup Range (34°42' S, 117°51' E).

Habitat. Occurs on coastal sand dunes, in deep sand or sandy clay on coastal plains or on limestone or granitic rises close to the coast. Common in Tuart open woodlands on the west coast from Geographe Bay northwards. Sometimes associated with watercourses or seasonally waterlogged depressions along the south coast.

Flowering period. Mainly September-December.

Affinities. Closest to *Pimelea ciliata,* also showing affinities with *P. ferruginea* and *P. hispida. Pimelea rosea* has softer leaves than *P. ferruginea* and *P. ciliata* and readily wilts after being picked.

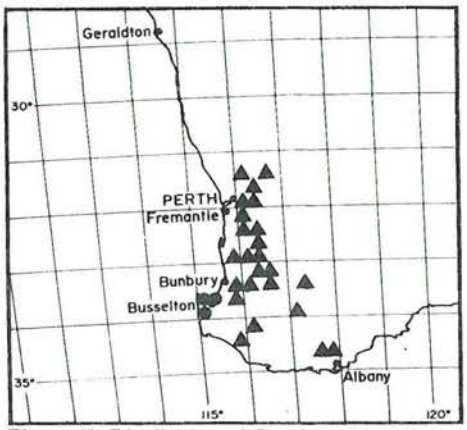

Figure 63. Distribution of *Pimelea ciliata* subsp. *ciliata* ▲ and *P. ciliata* subsp. *longituba* ●.

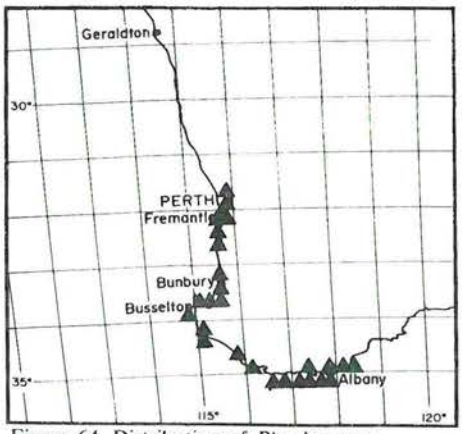

Figure 64. Distribution of *Pimelea rosea*.

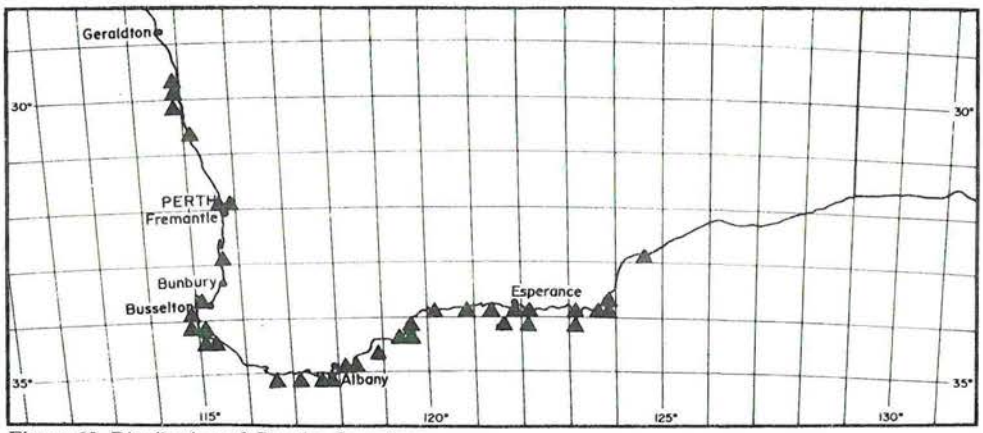

Figure 65. Distribution of *Pimelea ferruginea*.

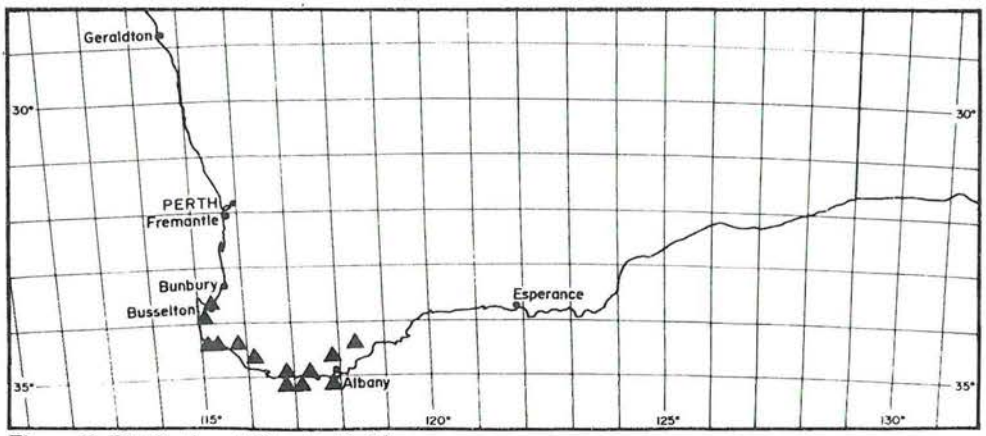

Figure 66. Distribution of *Pimelea hispida*.

41. **Pimelea ferruginea** Labill., Nov. Holl. Pl. 1: 10, t. 5 (1805). — *Banksia ferruginea* (Labill.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* "Van-Leuwin" [actually collected at Esperance Bay], Western Australia, 11-18 Dec. 1792, *J.J.H. de Labillardiere* (holo: presumably at FI, n.v.; iso: MEL).

Pimelea decussata R. Br., Prodr. 360 (1810). — *Heterolaena decussata* (R. Br.) C. Meyer, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 73 (1845). *Type:* King George Sound, Western Australia, Dec. 1801, *R. Brown* (BM).

Shrub, erect, 0.3-1.5 m high, usually single-stemmed at ground level, many-branched and dense above. *Stems* deep red-brown to black, often somewhat hairy when young, the hairs 0.5-2 mm long. *Leaves* usually patent; petiole 0.1-1 mm long; lamina very discolorous, a much darker green on adaxial surface than on abaxial surface, elliptic to narrowly elliptic or nearly so, 5-16 x 1.5-6.5 mm, with recurved margins, mucronulate and recurved at apex. *Peduncle* up to 3 mm long. *Involucral bracts* 4, usually green and partially pink to deep pink throughout, usually broadly ovate, 5-14 x 5-10 mm, sometimes with a few hairs at extreme base inside, usually ciliate, otherwise glabrous; cilia 0.5-2(-3) mm long. *Inflorescence* erect. *Pedicels* 0.5-1.2 mm long; hairs 0.5-2(-3) mm long. *Flowers* bisexual, pale to deep pink, not circumscissile, glabrous inside; tube 7-13 mm long. *Ovary-portion of floral tube* c. 2.5 x 1.2 mm, with minute antrorse hairs 0.1-0.5 mm long, often with long hairs in distal part or throughout. *Style-portion of floral tube* 4.5-10 mm long, 0.7-1.1 mm diam. at summit, with a mixture of long patent hairs 1.5-2(-3) mm long and short hairs 0.1-0.4 mm long in proximal part, with antrorse hairs 0.4-0.8 mm long in distal part. *Sepals* ovate, 2.5-4 mm long, with medium-sized and long hairs, the longest hairs 1-2(-3) mm long. *Stamens* usually slightly exceeding sepals; filament 1.5-3 mm long; anther 0.6-1.3 x c. 0.3 mm; slits semi-lateral to lateral after dehiscence. *Style* exserted by 2-4 mm. (Figure 62.)

Specimens examined. WESTERN AUSTRALIA (selected from over 150 seen): Sandy Point, *J.S. Beard* 1883 (PERTH); 10 mi [16 km] W of Point Culver, *M.G. Brooker* 3706 (PERTH); Two Peoples Bay, *N.T. Burbidge* 8097 (CANB); Bremer Bay, *M.G. Corrick* 7647 (MEL); Whitford Ave, at intersection of West Coast Hwy, *H. Demarz* 4098 (PERTH); Israelite Bay, *N.N. Donner* 2820 (AD, PERTH); c. 0.5 km W of Esperance, *H. Eichler* 19940 (AD, PERTH); Point Malcolm, *C.A. Gardner* 12928 (PERTH); near East Mt Barren, *C.A. Gardner* 13686 (PERTH); Culham Inlet, *A.S. George* 541 (PERTH); 19 km W of Lake Indoon, *R.J. Hnatiuk* 760192 (PERTH); c. 5 km NE of Hamelin Bay, *N.S. Lander* 1005 (PERTH); Cape Le Grand, *T.B. Muir* 4267 (MEL); 6.5 mi [10.5 km] S of Kundip, *K. Newbey* 572 (PERTH); Meelup-Eagle Bay, *S. Paust* 137 (PERTH); 10.6 km W of Esperance, *B.L. Rye* 82017 (PERTH); 10 km S of Freshwater Point., *R. Story* 8235 (CANB, PERTH); Observatory Is., *A.S. Weston* 9381 (CANB, PERTH); Gull Rock headland, Albany, 13 Oct. 1968, *J.W. Wrigley* (CBG, NT); Cape Leeuwin, 16 Oct. 1968, *J.W. Wrigley* (BRI, CBG).

Distribution. (Figure 65.) Extends around the coast from Cliff Head (29°32' S, 114°59' E) to near Point Culver (c. 32°55' S, 124°35' E).

Habitat. Occurs on coastal sand dunes and in sand over granite or other types of rocks on coastal headlands, in low coastal shrublands.

Flowering period. August-February.

Affinities. Closest to *Pimelea rosea* and *P. ciliata.*

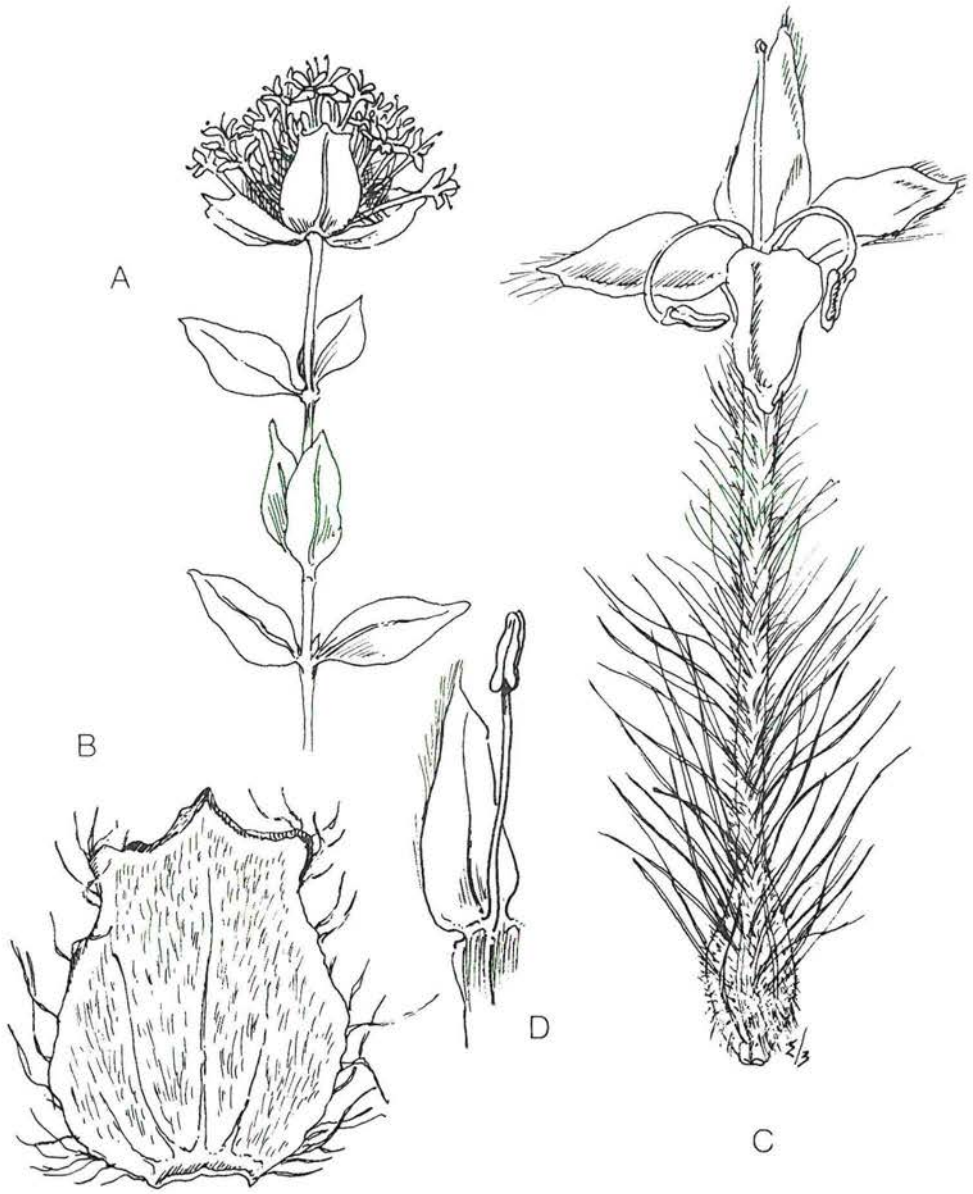

Figure 67. *Pimelea hispida.* A- flowering stem; B- inner surface of bract (x 4); C- flower (x 7.5); D- stamen (x 10). Drawn from *A.M. Ashby* 2682.

42. **Pimelea hispida** R. Br., Prodr. 360 (1810). — *Heterolaena hispida* (R. Br.) C. Meyer, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 73 (1845). — *Banksia hispida* (R. Br.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* King George Sound, Western Australia, Dec. 1801, *R. Brown* (BM).

Shrub, erect, 0.4-1.5 m high, single-stemmed at ground level. *Stems* usually red-brown near each inflorescence, becoming dark grey-brown further from apex. *Leaves* usually antrorse; petiole 1-2 mm long; lamina discolorous, medium green on adaxial surface and a paler green on abaxial surface, elliptic or nearly so, 9-29 x 2-9 mm, flat or with margins recurved, obtuse

to mucronulate. *Peduncle* 5-40 mm long. *Involucral bracts* 4, green and usually with pink or yellow portions, broadly ovate, 9-20 x 7-13 mm, glabrous outside, outer bracts appressed-hairy inside at least from the centre to the base, not ciliate; inner bracts appressed-hairy inside except for a narrow glabrous band around the margin, ciliate, the longest cilia 1(-2) mm long. *Inflorescence* erect. *Pedicels* 0.4-1 mm long; hairs up to 4 mm long. *Flowers* bisexual or very rarely female, pale to rose pink, not circumscissile, glabrous inside; tube usually 11-16 mm long. *Ovary-portion of floral tube* 2.5-3.5 x c. 1 mm, with retrorse to almost patent hairs mostly 0.5-1 mm long, often combined with a few long hairs towards summit. *Style-portion of floral tube* 8-12 mm long, 1-1.5 mm diam. at summit, with mixed long and short hairs; long hairs patent, concentrated and 4-5 mm long in proximal half, more scattered and 2.5-3 mm long in distal half; short hairs of proximal half usually patent, 0.1-0.5 mm long; short hairs of distal part antrorse, 0.5-1.5 mm long, somewhat wavy or curly. *Sepals* almost ovate, 2.5-5 mm long, with hairs similar to those on distal part of floral tube and a few longer hairs, the longest hairs 2.5-4 mm long. *Stamens* nearly always exceeding sepals; filament 2-3.5 mm long; anther 1-1.25 x 0.2-0.5 mm; slits semi-lateral or lateral after dehiscence. *Style* exserted by 3.5-5.5 mm. (Figure 67.)

Specimens examined. WESTERN AUSTRALIA (selected from over 65 seen): W of Pemberton, *T.E.H. Aplin* 1454 (PERTH); near Augusta, *A.M. Ashby* 2682 (AD, PERTH); c. 1.9 mi [3 km] NW of Youngs Siding, 12 Oct. 1968, *E.M. Canning* (CBG); Parry Inlet, *C.A. Gardner* 13031 (PERTH); Three Chain Rd, c. 7 km ENE of Scott River, *E.N.S. Jackson* 3284 (AD); Wilson Inlet, 22 Dec. 1877, *F. Mueller* (MEL); Bluff Knoll, *K. Newbey* 613 (PERTH); Big Grove, S of Albany, *S.P. Pfeiffer* 5 (PERTH); between Augusta and Cape Leeuwin, *M.E. Phillips* 2492 (CBG); W of Nornalup, *R.D. Royce* 8114 (PERTH); Peaceful Bay, *D.J.E. Whibley* 3301 (AD).

Distribution. (Figure 66). Extends from Geographe Bay (c. 33°37' S, 115°27' E) east-south-east to Albany (32°02' S, 117°53' E) and from Albany north to Bluff Knoll (34°23' S, 118°115' E).

Habitat. Recorded on seasonally waterlogged flats and on coastal sand hills.

Flowering period. September-December.

Affinities. Closest to *Pimelea lanata,* also similar to *P. rosea.*

43. **Pimelea lanata** R. Br., Prodr. 360 (1810). — *Calyptrostegia lanata* (R. Br.) Endl., Gen. Pl. Suppl. 4: 61 (1848). — *Pimelea hispida* var. *lanata* (R. Br.) Diels & E. Pritzel, Bot. Jahrb. Syst. 35: 394 (1904). *Type:* King George Sound, Western Australia, Dec. 1801, *R. Brown* (BM).

Shrub (sometimes almost a *tree*), erect, 0.7-4 m high, single-stemmed at ground level, with slender open branches above. *Stems* very dark red-brown near each inflorescence, becoming dark grey-brown further from apex. *Leaves* antrorse; petiole 0.2-1.3 mm long or often absent in leaves directly below an inflorescence; lamina concolorous or nearly so, medium green but reddish or yellowish on extreme margin, usually narrowly elliptic or nearly so but often ovate in the leaves directly below the inflorescence, 9-25 x 2-10 mm or rarely a few leaves smaller, flat or adaxially concave, minutely apiculate or mucronulate. *Peduncle* 3-45 mm long in flower, up to 70 mm long in fruit. *Involucral bracts* 4, largely green but cream to yellow and sometimes pink-tinged on the margins, ovate, 6-13 x 4-8 mm, glabrous outside, the yellowish margins 0.5-1.5 mm wide; outer bracts partially appressed-hairy inside, not ciliate; inner bracts appressed-hairy inside, ciliate, the longest cilia 1-2 mm long. *Inflorescence* erect. *Pedicels* 0.3-1 mm long; hairs 1-3 mm long. *Flowers* bisexual, white or pale to deep pink, often white in the basal part and pink above, glabrous inside; tube 7-10.5 mm long, circumscissile usually 2-3 mm above ovary-portion. *Ovary-portion of floral tube* 2-2.5 x c.

Figure 68. *Pimelea lanata*. A- flowering stem; B- inner surface of bract (x 5); C- flower (x 7.5); D- stamen (x 10). Drawn from *E. Wittwer* 2250 (A, B) and *R.D. Royce* 1161 (C, D).

1 mm, with reflexed hairs 0.1-0.3 mm long, with a few long antrorse or patent hairs near summit. *Style-portion of floral tube* 5-8 mm long, c. 1 mm diam. at summit, with a mixture of long patent hairs and much shorter hairs; long hairs concentrated or sometimes confined in proximal part, 2-3.5 mm long in proximal half, often reduced to 1-2.5 mm long in distal half; short hairs c. 0.2 mm long in proximal half and c. 0.5 mm long in distal half. *Sepals* narrowly ovate or ovate, 2.5-3.5 mm long, with long and short hairs, the long hairs c. 2 mm long. *Stamens* exceeding sepals; filament 3-4.5 mm long; anther 1.5-1.8 x c. 0.2 mm, slits semi-lateral to lateral after dehiscence. *Style* exserted by 4.5-5.5 mm. (Figure 68.)

Specimens examined. WESTERN AUSTRALIA (selected from over 45 seen): Black Point, *P. Christensen* 274 (PERTH); Thornlie, *H. Demarz* 2114 (PERTH); 25 mi [40.5 km] S of Bunbury, *A.S. George* 15 (PERTH); Picton Junction, *M. Koch* 2657 (MEL); Kelmscott, 14 Feb. 1902, *A. Morrison* (BRI); 10 mi [16 km] E of Denmark, *K. Newbey* 1240 (PERTH); c. 10 km W of Cookernup, *A.E. Orchard* 4298 (AD, PERTH); Ludlow, *R.D. Royce* 1161 (PERTH); Boyanup, *R.D. Royce* 1295 (PERTH); Scott River, *E. Wittwer* 2250 (PERTH).

Distribution. (Figure 72.) Extends from Thornlie (32°04' S, 115°57' E) around the coast to Albany (35°02' S, 17°53' E).

Habitat. Occurs in seasonally waterlogged depressions or low-lying flats on the coastal plain, in sand or sandy soil over clay, often associated with paperbarks or other characteristic plants of wetland vegetation.

Flowering period. Mainly December-February, also March-August.

Affinities. Closest to *Pimelea hispida,* possibly also with affinities to *P. rara.*

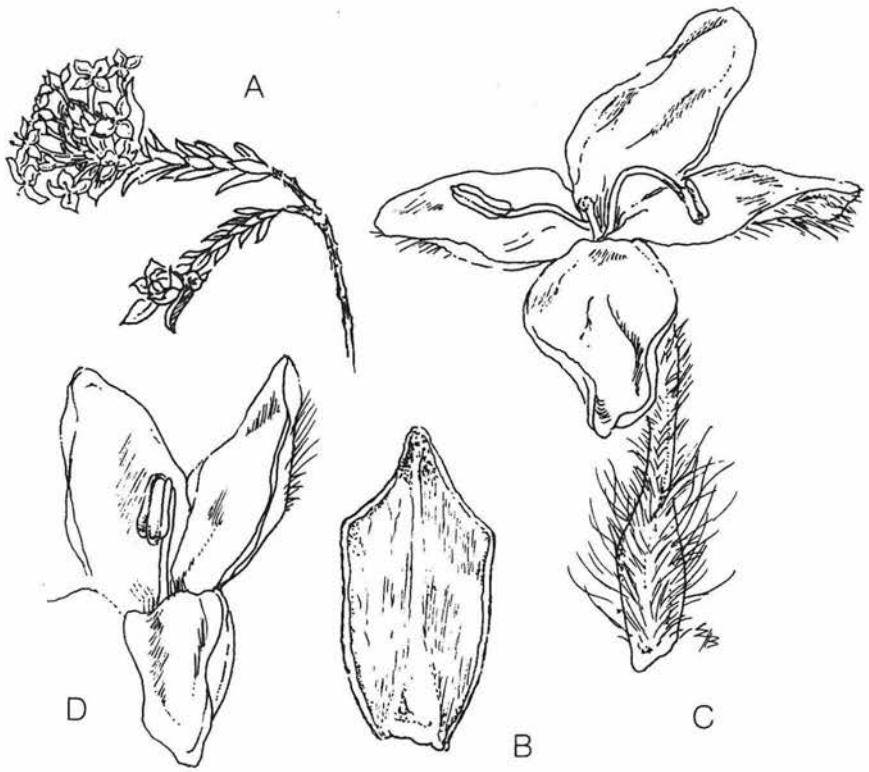

Figure 69. *Pimelea brevifolia* subsp. *brevifolia.* A- flowering stem; B- outer surface of bract (x 6); C- flower (slightly foreshortened) (x 9); D- stamen (x 9). Drawn from fresh material represented by *N. Cohen* 1004 (A, C, D) and *N. Cohen* 1008 (B).

44. **Pimelea brevifolia** R. Br., Prodr. 359 (1810). — *Calyptrostegia brevifolia* (R. Br.) C. Meyer, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 74 (1845). — *Banksia brevifolia* (R. Br.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* King George Sound, Western Australia, Dec. 1801, *R. Brown* (BM).

Undershrub or *shrub*, 0.1-1 m high, often multi-stemmed at ground level. *Stems* reddish brown to pale yellowish brown near each inflorescence, becoming dark grey to black then medium grey to brown further from apex. *Leaves* antrorse or rarely patent, sessile or with a petiole up to 0.3 mm long; lamina concolorous or nearly so, usually medium green, narrowly elliptic or rarely elliptic, 1-16 x 0.5-6 mm, flat or adaxially concave, acute or obtuse, often mucronulate. *Peduncle* (1-)5-20(-30) mm long. *Involucral bracts* 4, similar in colour to leaves or more yellowish, sometimes reddish at base or apex, narrowly ovate to broadly elliptic or broadly ovate, 4-12 x 3-9 mm, glabrous inside, rarely ciliate towards base, the longest cilia 0.5-0.8 mm long. *Inflorescence* erect. *Pedicels* c. 0.5 mm long; hairs up to 2 mm long. *Flowers* bisexual or female, white or rarely pale yellow, not circumscissile, glabrous inside; tube 6-12 mm long. *Ovary-portion of floral tube* 2-3 x 0.7-1 mm, with short or long hairs or a mixture of both; hairs antrorse, the longest ones 0.3-2 mm long. *Style-portion of floral tube* 3-8 mm long, 0.6-1 mm diam. at summit, either shortly hairy throughout or with a mixture of long patent and short hairs in proximal part and shortly hairy above, the longest hairs up to 2 mm long. *Sepals* ovate to broadly ovate-elliptic, 2-4 mm long, with short hairs similar to those on distal part of floral tube and longer hairs up to 1.3 mm long. *Stamens* shorter than sepals; filament 0.3-1.5 mm long; anther 0.6-1.1 x 0.2-0.4 mm; slits semi-lateral to almost adaxial after dehiscence. *Style* exserted by up to 2 mm or very rarely not exserted. (Figures 69, 70.)

Distribution. (Figure 73.) Extends from near Wubin south to Albany and south-east to Israelite Bay.

Flowering period. July-October.

Affinities. Close to *Pimelea brachyphylla.*

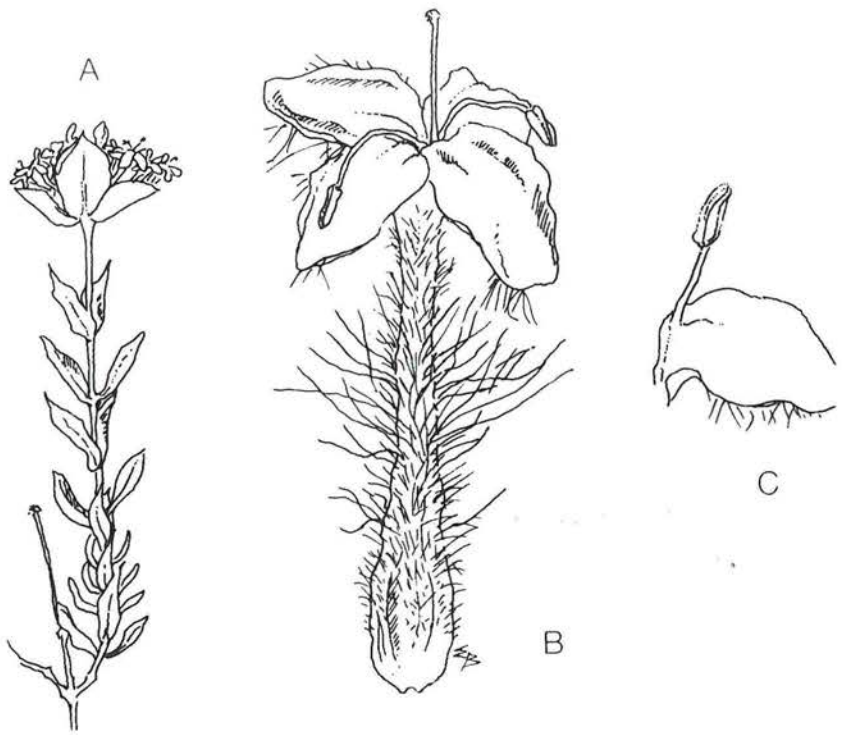

Figure 70. *Pimelea brevifolia* subsp. *modesta.* A- flowering stem; B- flower (x 9); C- stamen (x 12). Drawn from *R.C. Cranfield* 1632.

Notes. Two subspecies are recognised. These are geographically parapatric, subsp. *modesta* occurring in the north and subsp. *brevifolia* in the south. The subspecies are very distinct in their typical states but tend to intergrade at the common border of their ranges in the Lake Grace area. Female plants are widespread but apparently less common than bisexual plants.

Key to Subspecies

1. Involucral bracts narrowly to broadly ovate. Floral tube with long hairs (often mixed with short hairs) on ovary-portion and short hairs above 44a. subsp. *brevifolia*
1. Involucral bracts elliptic or broadly elliptic. Floral tube shortly hairy on ovary-portion, with a mixture of long patent hairs and short hairs on lower part of style-portion and short hairs above.....44b. subsp. *modesta*

44a. subsp. **brevifolia**

Pimelea brevifolia var. *angustifolia* Benth., Fl. Austral. 6: 12 (1873). *Type:* Cape Arid, Western Australia, date unknown, *G. Maxwell* (holo: K; iso: MEL).

Pimelea maxwellii F. Muell. ex Benth., Fl. Austral. 6: 12-13 (1873). — *Banksia maxwellii* (F. Muell. ex Benth.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* Gordon River, Western Australia, date unknown, *A.F. Oldfield* (lecto here designated: K); Kalgan River, Western Australia, date unknown, *A.F. Oldfield* (isosyn: MEL); McCallum Inlet, Western Australia, date unkown, *G. Maxwell* (isosyn: MEL); Esperance Bay, Western Australia, date unknown, *G. Maxwell* (isosyn: MEL).

Undershrub or *shrub,* 0.15-1 m high. *Leaves* usually fairy uniform in size, (3-)5-16 x (1-)1.5-3 mm. *Involucral bracts* narrowly to broadly ovate. *Floral tube* with long hairs confined to ovary-portion or extending from distal part of ovary-portion to proximal part of style-portion and shorter hairs above; long hairs 1-2 mm long, often mixed with minute hairs 0.1-0.3 mm long, coarse to medium in thickness; short hairs of distal part few to numerous, appressed or closely antrorse, 0.1-0.7 mm long, fine. *Anther slits* semi-lateral to almost adaxial after dehiscence. (Figure 69.)

Specimens examined. WESTERN AUSTRALIA (selected from over 70 seen): Stirling Range, *A. Ashby* 47 (AD, PERTH); 18 mi [29 km] SE of Ongerup, *E.M. Bennett* 986 (PERTH); near Pingrup, *W.E. Blackall* 3069 (PERTH); c. 4 km N of Howick Hill, *N.N. Donner* 2690 (AD, PERTH); c. 8 km W of Israelite Bay, *N.N. Donner* 2825 (AD, PERTH); c. 30 km NNE of Young River crossing on Ravensthorpe-Esperance road, *N.N. Donner* 3043 (AD, PERTH); Middle Mt Barren, *C.A. Gardner* 9171 (PERTH); 7.2 km W of Point Malcolm, *R.J. Hnatiuk* 761088 (PERTH); Bluff Knoll, Stirling Range, *T.B. Muir* 3870 (MEL); 10 km E of Cape Le Grand, *T.B. Muir* 4299 (MEL); 1 mi [1.5 km] E of Lake Grace, *K. Newbey* 1017 (PERTH); Mt Toolbrunup, *K. Newbey* 1309 (PERTH); 25 mi [40 km] W of Ravensthorpe, *S. Paust* 716 (Perth); Mt Ragged, *R.A. Saffrey* 1318 (PERTH).

Distribution. (Figure 73.) Extends from Lake Grace (33°06' S, 118°28' E) south to Albany (35°02' S, 117°53' E) and east to near Israelite Bay (c. 33°37' S, 123°52' E).

Habitat. Occurs in sandy soils or sometimes clay, often with laterite or granite. Recorded in shrublands.

Flowering period. July-October.

Notes. In the eastern part of the range of this subspecies, particularly between Esperance and Israelite Bay, the flowers have large hairs on the ovary-portion of the floral tube but not on the style-portion. From Esperance westwards, the large hairs of the floral tube tend to become progressively higher in their position on the tube. In the northernmost populations of subsp. *brevifolia* (in the eastern part of its range), the position of the large hairs on the floral tube approaches that in subsp. *modesta*. A few specimens from the eastern part of the range have subsessile anthers with more or less adaxial slits and the style not or scarcely exserted.

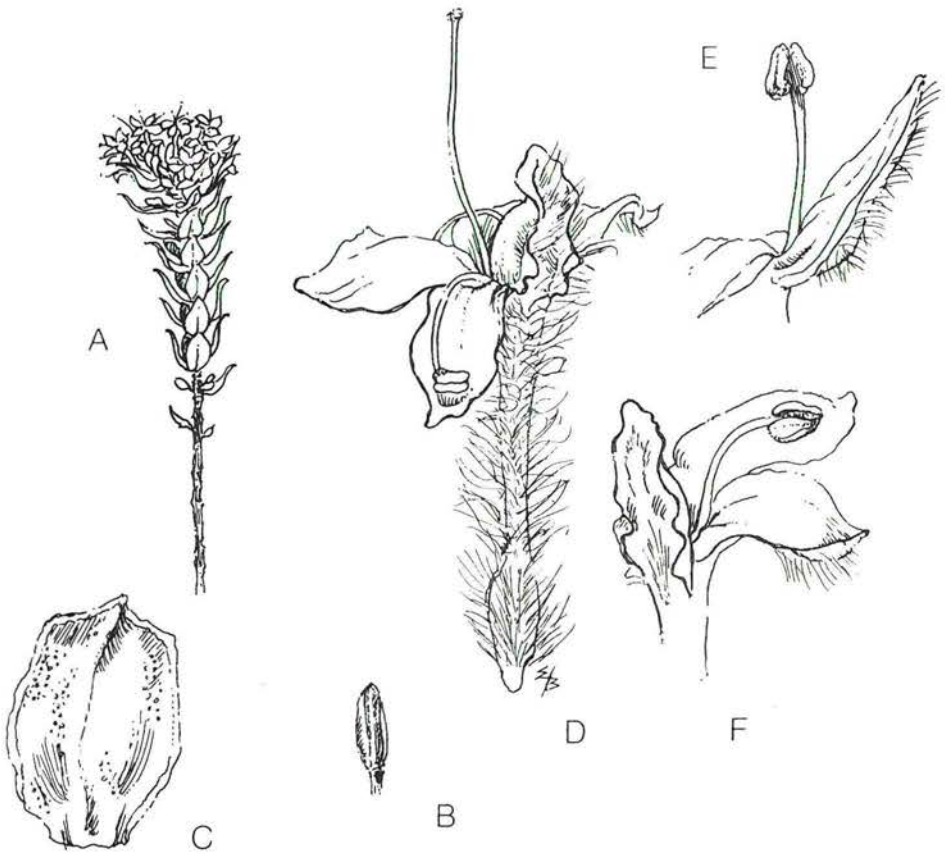

Figure 71. *Pimelea brachyphylla*. A- flowering stem; B- leaf; C- outer surface of bract (x 7); D- flower (x 10); E- stamen (x 14); F- older stamen (x 14). Drawn from *N. Cohen* 1017 (A, C, D, E, F) and *K. Newbey* 9841 (B).

44b. subsp. **modesta** (Meissner) Rye, comb. et stat. nov. (Figure 70.)

Pimelea modesta Meissner in Lehm., PL. Preiss. 2: 269-270 (1848). *Type:* south-western Australia, 1843-1844, *J. Drummond* coll. 3, n. 238 (iso: K, MEL, NY).

Undershrub or *shrub*, 70 mm-1 m high. *Leaves* often very variable in size on each stem, the smaller leaves 1-6 x 0.5-2 mm, the larger leaves 6-14 x 1.5-6 mm. *Involucral bracts* elliptic or broadly elliptic. *Floral tube* with antrorse to patent hairs, those on ovary-portion 0.1-0.3 mm long, with a mixture of hairs 1.2-2 mm long and much shorter hairs 0.1-0.3 mm long in proximal part of style-portion and hairs 0.4-1 mm long above. *Anther slits* semi-lateral after dehiscence.

Specimens examined. WESTERN AUSTRALIA (selected from over 30 seen): Muntadgin, *E.T. Bailey* 447 (PERTH); 242 mi peg [390 km], Great Eastern Hwy, *H. Demarz* 5251 (PERTH); Yorkrakine, *C.A. Gardner* coll. 1, n. 660 (PERTH); near Bullabulling, *C.A. Gardner* 13511 (PERTH); 4.4 mi [7 km] W of Yoting, *N.G. Marchant* 70/279 (PERTH); North Tarin Rock Reserve, *B.G. Muir* 361 (PERTH); 80 km WNW of Kumarl, *T.B. Muir* 4373 (MEL); 10 mi [16 km] S of Gorge Rock, Corrigin-Kondinin, *K. Newbey* 2616 (PERTH); 7 mi [11 km] W of Dowerin, 19 Sept. 1962, *M.E. Phillips* (CBG); 55 mi [89 km] E of Southern Cross, *M.E. Phillips* 697 (CBG); near Tammin, *E. Pritzel* 750 (PERTH); Boxvale, 50 mi [80 km] E of York, *J.S. Wells* (MEL); at Rabbit Proof Fence, NE of Wubin, *F.W. Went* 181 (PERTH).

Distribution. (Figure 73.) Extends from near Wubin (30°07' S, 116°38' E) south-east to Lake Grace (33°06' S, 118°28' E) and inland to Coolgardie (30°57' S, 121°10' E) and Norseman (32°12' S, 121°46' E).

Habitat. Occurs in sand.

Flowering period. August-October.

45. **Pimelea brachyphylla** Benth., Fl. Austral. 6: 11 (1873). — *Banksia brachyphylla* (Benth.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* south-western Australia, 1848, *J. Drummond* coll. 5, n. 429 (lecto here designated: K; isolecto: MEL).

Shrub or *undershrub,* usually erect, 0.1-1 m high, single-stemmed at ground level. *Stems* black or sometimes dark red-brown near each inflorescence, becoming medium grey further from apex. *Leaves* patent or antrorse; petiole absent or up to 0.3 mm long; lamina discolorous, green or glaucous and often very dark on adaxial surface, paler green on abaxial surface, linear to elliptic-oblong, 2-10 x 1-3 mm, with revolute margins, the apex mucronate and recurved. *Peduncle* up to 3 mm long. *Involucral bracts* 4 or 6, green with a reddish margin or sometimes with more widespread red, elliptic, ovate or broadly elliptic, 4.5-8 x 2.5-7 mm; outer bracts and medial bracts (when present) glabrous or less hairy than innermost bracts; innermost bracts often partially appressed-hairy inside, often ciliate, the longest cilia 1-1.5 mm long. *Inflorescence* erect. *Pedicels* c. 0.5 mm long; hairs 1-2.5 mm long. *Flowers* bisexual or female, white, not circumscissile, glabrous inside; tube 4-8 mm long. *Ovary-portion of floral tube* 1-1.5 x 0.5-1 mm, glabrous at base, with short patent to antrorse hairs 0.1-0.3 mm long above, sometimes with long hairs near summit. *Style-portion of floral tube* 2.5-5 mm long, 0.4-1 mm diam. at summit, with short patent to antrorse hairs 0.1-0.5 mm long, often with long patent hairs, 0.6-2 mm long in proximal part and sometimes throughout. *Sepals* ovate, 1.5-3 mm long, hairy, the longest hairs 1-1.5(-2) mm long. *Stamens* exceeding or sometimes equalling sepals; filament 1.5-3 mm long; anther 0.3-0.5 x c. 0.2 mm; slits semi-lateral after dehiscence. *Style* exserted by 1.5-3 mm. (Figure 71.)

Specimens examined. WESTERN AUSTRALIA (selected from over 65 seen): Tarin Rock, *A.M. Ashby* 2 (AD); 20 mi [32 km] E of Katanning, *W.E. Blackall* 2988 (PERTH); Pingrup, *W.E. Blackall* 3031 (PERTH); c. 2 km N of Howick Hill, *N.N. Donner* 2713 (AD, PERTH); c. 58 km N of mouth of Oldfield River, *H. Eichler* 20380 (AD, PERTH); Mt Short, *A.S. George* 5720 (PERTH); 5.5 mi [9 km] NE of Esperance, *A.S. George* 9854 (PERTH); 8 mi [12 km] N of Israelite Bay, 13 Sept. 1972, *E.C. Nelson* (CANB); 4 mi [6.5 km] NW of Ongerup, *K. Newbey* 332 (PERTH); 2 mi [3 km] E of Ravensthorpe, *K. Newbey* 2757 (PERTH); c. 13 km N of coast at Stokes Inlet, *A.E. Orchard* 1176 (AD, CANB); Howick Rd, SW of Mt Ney, *B.L. Rye* 82030 (PERTH); S of Grasspatch, 1 Sept. 1947, *J.H. Willis* (MEL); 2 km SW of Mt Madden, *P.G. Wilson* 6815 (PERTH).

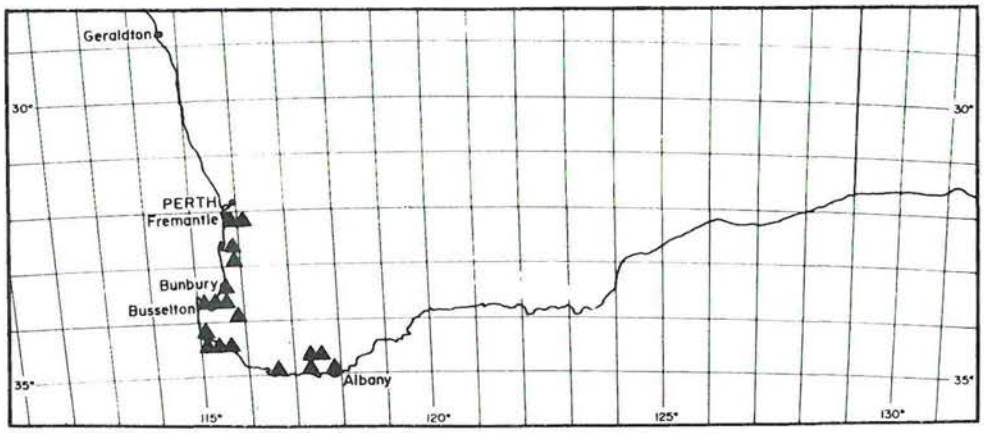

Figure 72. Distribution of *Pimelea lanata* ▲.

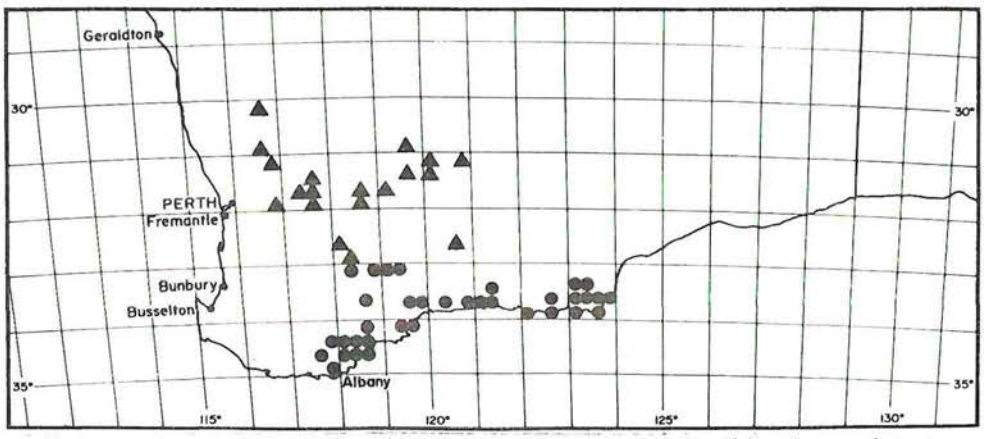

Figure 73. Distribution of *Pimelea brevifolia* subsp. *brevifolia* ● and *P. brevifolia* subsp. *modesta* ▲.

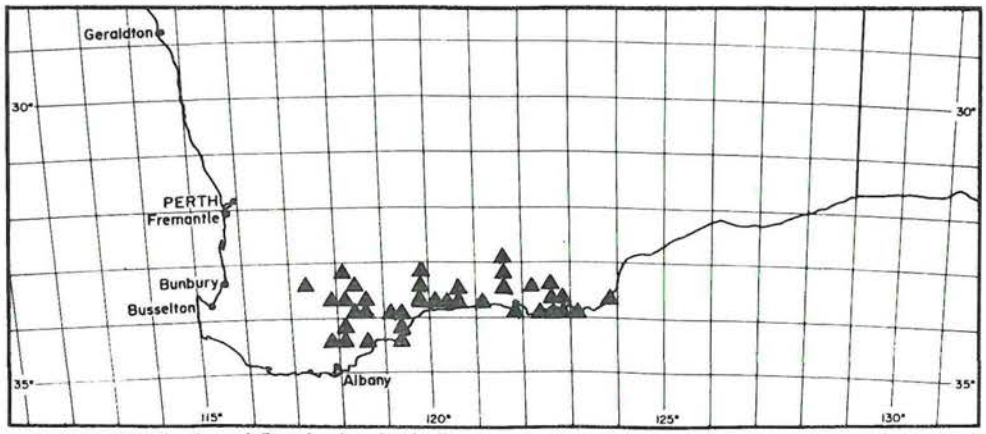

Figure 74. Distribution of *Pimelea brachyphylla*.

Distribution. (Figure 74.) Extends from near Wagin (c. 33°19' S, 117°21' E) east to Israelite Bay (33°35' S, 123°50' E).

Habitat. Recorded in sand, gravel, clay, laterite, granite and combinations of these, on rocky outcrops or flat plains, in mallee woodlands or shrublands. Sometimes recorded near ephemeral lakes or along watercourses.

Flowering period. July-October.

Affinities. Closest to *Pimelea brevifolia* and *P. avonensis.*

Notes. As female specimens have been collected widely in its range, the species appears to be uniformly gynodioecious. Female plants are less frequent in the herbarium collections than bisexual plants and also appear, from the limited field work undertaken in this study, to be less common in the field.

As presently recognised, *Pimelea brachyphylla* is a very variable taxon. In the western part of its range, from Wagin to Ravensthorpe, there are two very distinct variants which could readily be recognised as separate species if it were not for the presence of intermediates in the eastern part of the species range. One of these variants has a spreading habit, usually forming a dome-shaped undershrub but sometimes having decumbent to prostrate stems. It has short spreading leaves, which are medium green when fresh but become very dark green in old specimens. Its flowers are small and usually have rather uniform coarse hairs, which are sometimes all very short. The bracts and the upper leaves are usually microscopically toothed and the inner bracts often lack cilia.

The second variant is restricted to the area east of Jerramungup and is an erect undershrub or shrub with longer glaucous leaves and longer flowers. Its bracts and leaves are entire and the inner bracts are long-ciliate. On the floral tube there is a mixture of short and long hairs, all quite fine.

East of Ravensthorpe some specimens match the first variant very well, a few are similar to the second variant but with green rather than glaucous leaves and the remainder are intermediate. A detailed field survey is needed to examine this group of plants to determine whether *P. brachyphylla* should be divided into infraspecific taxa or whether more than one species should be recognised.

2. **THECANTHES** Wikstrom

Thecanthes Wikstrom, Kongl. Vetensk. Acad. Handl. 271 (1818). — *Pimelea* a. *Thecanthes* (Wikstrom) Endl., Gen. Pl. 331 (1837). — *Calyptrostegia* A. *Calyptridium* Endl., nom. illegit. a. *Thecanthes* (Wikstrom) Endl., Gen. Pl. Suppl. 4: 62 (1848). — *Pimelea* sect. *Thecanthes* (Wikstrom) Meissner in DC., Prodr. 14: 496 (1857). — *Pimelea* subgen. *Thecanthes* (Wikstrom) Gilg in A. Engler & K. Prantl, Nat. Pflanzenfam. 111, 6a: 24 (1894). — *Banksia* sect. *Thecanthes* (Wikstrom) Kuntze in T. Post & Kuntze, Lex. Gen. Phan. 59 (1903). *Type: T. punicea* (R. Br.) Wikstrom (lecto, fide S. Threlfall, Brunonia 5: 118 (1983)).

Annual herbs (possibly rarely *biennials*), usually erect, single-stemmed at ground level, usually branched above, often reddish or maroon at base or on major branches, hermaphrodite, glabrous. *Stems* sometimes with a stringy bark, fibrous beneath and hollow at the centre when dried; branches often arising in pairs from opposite leaf axils; nodes not protruding abaxially beyond the petiole. *Leaves* opposite or subopposite, decussate, shortly petiolate. *Inflorescence* a head-like condensed raceme, terminal, erect; receptacle concave; involucral bracts 4, appearing to form a continuation of the receptacle; pedicels dorsiventrally compressed, articulate at apex, the apical scar left when fruit is shed being circular or elliptic. *Flowers* white to deep red, completely glabrous or rarely (not in Western Australia) with simple hairs on base of floral tube. *Floral tube* of 2 portions surrounding the ovary and style respectively; ovary-portion fusiform; style-portion narrowly cylindric, very slender at base, broadest at summit, the gradual expansion occurring mainly in the distal half, circumscissile above ovary in fruit. *Sepals* 4, the outer pair overlapping inner pair in bud, widely spreading in flower (in Western Australia). *Corolla lobes* absent. *Stamens* 2, inserted at summit of floral tube opposite outer sepals. *Ovary* 2-carpellate at first, effectively 1-locular at maturity; ovule 1. *Style* arising laterally just below apex of ovary, filiform; stigma small, papillose. *Fruit* indehiscent, dry, enclosed in ovary-portion of floral tube.

A genus of 5 species, extending from the Philippines to northern Australia, 3 species occurring in Western Australia.

Notes. The name *Thecanthes* is derived from the Greek words *theca* (envelope, sac) and *anthos* (flower), presumably referring to the sac-like concave receptacle and attached bracts enclosing the flowers.

Key to Species

1. Flowers white or sometimes pale pink, with pinkish anthers. Floral tube 9-11 mm long. Stamen filaments longer than sepals.....1. *T. concreta*
1. Flowers deep red, with bright yellow anthers. Floral tube 4-9 mm long. Stamen filaments shorter than sepals.
   2. Peduncle (6-)20-85 mm long. Involucral bracts broadly ovate to depressed ovate, apiculate. Sepals 2.5-5 mm long. Anthers 1-1.4 mm long.....2. *T. punicea*
   2. Peduncle 1-7 mm long. Involucral bracts narrowly ovate or ovate, acute. Sepals 1.5-2.5 mm long. Anthers 0.4-0.8 mm long.....3. *T. sanguinea*

1. **Thecanthes concreta** (F. Muell.) Rye, comb. nov.

Pimelea concreta F. Muell., Fragm. 5: 73-74 (1865). — *Banksia concreta* (F. Muell.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* Camden Harbour, Western Australia, date unknown, *J.S. Roe* (holo: MEL).

Pimelea brevituba Fawcett in Forbes, A Naturalist's Wanderings 516 (1885). *Type:* Mt Sobale, Samoro, Timor, 28 Apr.-3 May 1883, *H.O. Forbes* 3828 (holo: BM).

Figure 75. *Thecanthes punicea*. A- flowering stem; B- receptacle and bracts; C- flower and pedicel (x 15); D- stamen (x 12); E- enclosed fruit and pedicel (x 12). Drawn from *A.S. George* 15129 (A, B) and *W.H. Butler* s.n. 1970 (C).

Annual herb, erect, 0.2-0.8 m high, unbranched or with long slender branches, the basal branches arising (10-)100-400 mm above ground level, completely glabrous. *Stems* often a deep red colour at base and sometimes partly reddish higher up, otherwise pale yellow-brown; main stem 1-8 mm diam. at base; branches (when present) usually at less than 30 degrees to the axis, the ultimate branches usually 60-280 mm long. *Leaves* more persistent than in *T. punicea*, the basal leaves usually narrowly oblong to narrowly obovate and broadly obtuse, the uppermost leaves usually narrowly ovate and acute; petiole 0.5-1.5 mm long; lamina usually pale to medium green, 9-38 x 2-6.5 mm. *Peduncle* (4-)8-75 mm long, 0.7-1.5 mm diam. at middle. *Receptacle* green, 3.5-6 x 5-9 mm at first, up to 8.5 x 16 mm in fruit. *Involucral bracts* green, broadly ovate to depressed ovate, 3-6 x 4-15 mm, apiculate. *Upper pedicels* triangular to shallowly triangular, up to 1.5 mm long, c. 0.2 mm wide at articulation point.

Flowers pure white or sometimes pink-tinged. *Floral tube* 9-11 x 1-1.6 mm, circumscissile 2-3 mm above base; ovary-portion 2-2.5 x 0.8-1.2 mm. *Sepals* ovate, 2.5-3.5 mm long, broadly obtuse. *Stamens:* filament 3-4 mm long, slightly to greatly exceeding sepals; anther pinkish, 0.8-1.4 mm long. *Style* exserted by 4-5 mm. *Fruit* (including persistent base of floral tube) pale brown at first, not spotted, becoming very dark brown to black, 3-4.5 x 1.3-1.9 mm.

Specimens examined. WESTERN AUSTRALIA: S of settlement, Kalumburu Mission, *T.E.H. Aplin et al.* 847 (PERTH); c. 140 km S of Kalumburu Mission settlement on road to Drysdale River Homestead, *T.E.H. Aplin et al.* 910 (PERTH); Mitchell Plateau, *J.S. Beard* 8464 (PERTH); Mitchell Plateau, *C.R. Dunlop* 5362 (DNA, MEL, PERTH); Gibb River Station, *J.N. Hutchinson* 12 (PERTH); Mitchell Plateau, *K.F. Kenneally* 6995 (PERTH); Mount House Station area, *D.E. Symon* 7050 (ADW, CANB, NT, PERTH); Mitchell River Station, *D.E. Symon* 10246 (ADW, PERTH); Phillips Range, *G.C. Taylor* 47 (MEL, NT).
NORTHERN TERRITORY (selected from 7 seen): East Alligator River, *C. Dunlop* 3327 (CANB, DNA, NT).

Distribution. (Figures 78, 80.) Occurs in the Northern Botanical Province, extending from Camden Harbour (15°30' S, 124°36' E), north-east to Kalumburu Mission (14°18' S, 126°38' E) and south-east to the Mount House Station area (c. 17°03' S, 125°42' E). Also occurs in Northern Territory and southern Indonesia. The distribution of the species in Indonesia, shown in Figure 80, is based on Domke (1934) and Ding Hou (1960).

Habitat. Recorded mainly in lateritic areas with *Eucalyptus* woodlands.

Flowering period. January-June.

Affinities. Closest to *Thecanthes punicea.*

2. **Thecanthes punicea** (R. Br.) Wikstrom, Kongl. Vetensk. Akad. Handl. 272 (1818). — *Pimelea punicea* R. Br., Prodr. 359 (1810). — *Calyptrostegia punicea* (R. Br.) Endl., Gen. Pl. Suppl. 4: 60 (1848). — *Banksia punicea* (R. Br.) Kuntze, Revis. Gen. Pl. 2: 583 (1891). *Type:* North Bay, Arnhem Land, Northern Territory, 16 Feb. 1803, *R. Brown* (lecto here designated: BM; isolecto: MEL); Bay No. 3, Northern Territory, 3 Mar. 1803, *R. Brown* (syn: BM).

Pimelea punicea var. *breviloba* F. Muell. ex Benth., Fl. Austral. 6: 6 (1873). *Type:* Purdie's Ponds, Northern Territory, date unknown, *J. McDouall Stuart* (lecto here designated: K; isolecto: MEL); upper Roper River and Hooker's and Sturt's Creeks, Northern Territory, date unknown, *F. Mueller* (syn: K).

Annual (possibly very rarely *biennial) herb*, erect, 0.2-0.6 m high, unbranched in basal (30-)50-250 mm, nearly always branched above, completely glabrous. *Stems* very pale brown or partly a deep red colour; main stem 1.7-4 mm diam. at base; branches usually several to many, usually at 30-45 degrees to the axis, the ultimate branches usually 40-140 mm long. *Leaves* often shed early from base of plant, the basal leaves (if present) usually narrowly obovate and obtuse, the uppermost leaves usually narrowly ovate to very narrowly ovate and acute to almost acuminate; petiole 0.5-2 mm long; lamina usually medium green, (5-)12-52 x (1-)3-8 mm. *Peduncle* (6-)20-85 mm long, 0.6-2 mm diam. at middle. *Receptacle* green or sometimes reddish, 3-5 x 4-7 mm at first, up to 8 x 13 mm in fruit. *Involucral bracts* green, very rarely slightly reddish inside, broadly ovate to depressed ovate, 4.5-10 x 6-12 mm, apiculate. *Upper pedicels* depressed ovate-triangular to oblong, up to 1.5 mm long, 0.2-0.5 mm wide at articulation point. *Flowers* deep red. *Floral tube* 5-9 x 1-1.5 mm, circumscissile 1.5-2.5 mm above base; ovary-portion usually 1.5-2 x c. 0.6 mm. *Sepals* narrowly ovate or ovate, 2.5-5 mm long, narrowly obtuse to acute. *Stamens*: filament 2-4.5 mm long, definitely shorter than to almost equalling sepals; anther bright yellow, 1-1.4 mm long. *Style* exserted by 3-6 mm. *Fruit* (including persistent base of floral tube) pale brown and almost always with deep red spots at first, becoming darker, 3-4.5 x 1.2-1.4 mm. (Figure 75.)

Figure 76. *Thecanthes sanguinea.* A- flowering stem; B- flower (x 10); C- stamen (x 14). Drawn from *E.M. Bennett* 1828 (A, B) and *S.F. Stokes* 5 (C).

Specimens examined. WESTERN AUSTRALIA (selected from c. 40 seen): N of Drysdale River Homestead, *T.E.H. Aplin et al.* 712 (PERTH); Goody Goody, Apr. 1905, *W.V. Fitzgerald* (NSW); Derby, *W.W. Froggat* 34 (NSW); Barker Gorge, Napier Range, *C.A. Gardner* 12212 (PERTH); Mount House Station, *J.N. Hutchinson* 9 (PERTH); Cockburn Range, *M. Lazarides* 8589 (NSW); 29 km SW of Gibb River Station, *D.E. Symon* 7067 (ADW, BRI, PERTH).

NORTHERN TERRITORY (selected from over 200 seen): 9 mi [15.5 km] S of Batchelor, *G. Chippendale* 7746 (BRI, CBG, MEL, NSW, PERTH); Yirrkala, *R.L. Specht* 905 (AD, ADW, BRI, CANB, MEL, NT).

Distribution. (Figures 77, 81.) Confined (in Western Australia) to the Northern Botanical Province, extending from the Fitzroy River area to the Cambridge Gulf-Lake Argyle area, with an isolated record from Kalumburu Mission. Also occurs in Northern Territory.

Habitat. Recorded in sand or sandy clay, often in rocky ground. Where specified the rocks have been recorded as basalt or sandstone, rarely with gravel.

Flowering period. Flowers recorded all year, especially April-July.

Affinities. Closest to *Thecanthes concreta.*

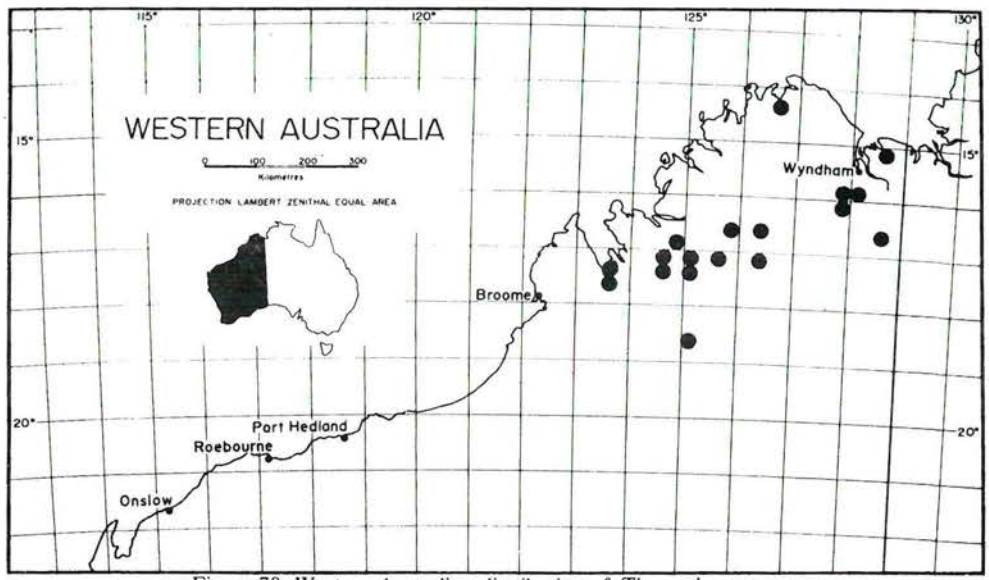

Figure 78. Western Australian distribution of *Thecanthes concreta.*

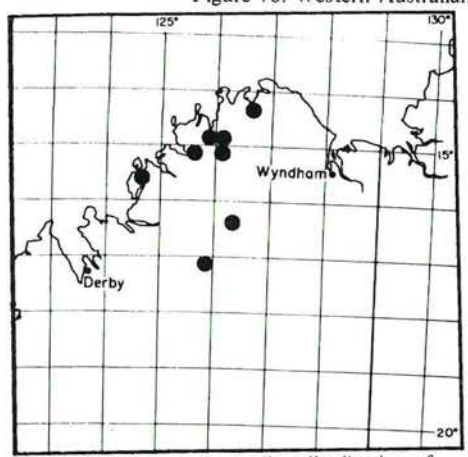

Figure 77. Western Australian distribution of *Thecanthes punicea.*

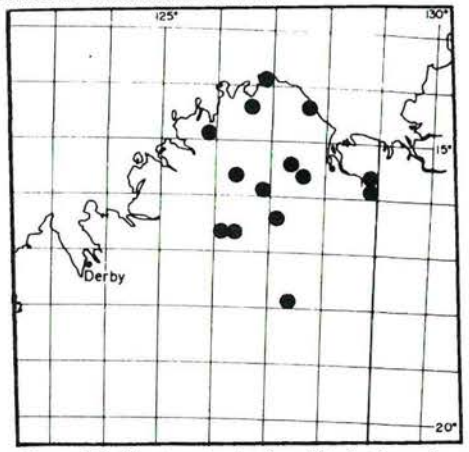

Figure 79. Western Australian distribution of *Thecanthes sanguinea.*

Notes. The type material from MEL was chosen as the lectotype because the type sheet borrowed from BM contained a mixture of the two syntypes and it was not clear to which syntype each piece of plant material belonged.

Nearly all Western Australian specimens have a spotted fruit, a character which provides an easy means of distinguishing *T. punicea* from other species of *Thecanthes.* However, the fruit is rarely if ever spotted in specimens of *T. punicea* from Northern Territory. In other characters *T. punicea* is much more variable in Northern Territory and the variants occurring there are in need of further study.

3. **Thecanthes sanguinea** (F. Muell.) Rye, comb. nov. (Figure 76.)

Pimelea sanguinea F. Muell., Fragm. 1: 84 (1859). — *Banksia sanguinea* (F. Muell.) Kuntze, Revis. Gen. Pl. 583 (1891). *Type:* Pandanus Springs, upper Roper River, Northern Territory, 20 July 1856, *F. Mueller* (holo: MEL).

Annual herb, erect or sometimes semi-prostrate, 0.1-0.3 m high, slender, unbranched in basal 6-120 mm, usually several-branched above, completely glabrous. *Stems* pale yellow-brown to dark red-brown; main stem 1-3 mm diam. at base; branches usually at 45-90 degrees to the axis, the ultimate branches 30-100 mm long. *Leaves* often shed early from base of plant, the basal and uppermost leaves often similar in shape; petiole 0.2-1 mm long; lamina medium to dark green, narrowly ovate to almost linear or sometimes (in basal leaves) narrowly elliptic to narrowly obovate, 5-34 x 1-7 mm, acute. *Peduncle* 1-7 mm long, 0.7-2 mm diam. at middle. *Receptacle* green or reddish, 1-2 x 3-6 mm at first, up to 4 x 9 mm in fruit. *Involucral bracts* green or sometimes reddish outside, deep red-purple or rarely green inside, narrowly ovate or ovate, 7-24 x 2.5-11 mm, acute. *Upper pedicels* shallowly triangular to oblong, usually c. 1 mm long, c. 0.3 mm wide at articulation point. *Flowers* deep red. *Floral tube* 4-6 x 0.7-1.5 mm, circumscissile 1.3-2.2 mm above base; ovary-portion usually 1.2-2.0 x 0.4-0.8 mm. *Sepals* narrowly ovate or ovate, 1.5-2.5 mm long, broadly obtuse. *Stamens:* filament 1-2 mm long, shorter than sepals; anther bright yellow, 0.4-0.8 mm long. *Style* exserted by 1-2 mm. *Fruit* (including persistent base of floral tube) pale or medium brown at first, not spotted, becoming black, 4-5 x 1.4-1.8 mm.

Specimens examined. WESTERN AUSTRALIA (selected from c. 20 seen): 3.6 km N of Kalumburu Mission settlement on road to Pago, *T.E.H. Aplin et al.* 862 (PERTH); 13 mi [21 km] W of Durack River, *E.M. Bennett* 1828 (PERTH); WSW of Cape Londonderry, *A.S. George* 13392 (PERTH); Mitchell Plateau, *K.F. Kenneally* 6732 (PERTH); 32 km NW of Ellenbrae Homestead, *A. Kubucki* 32 (PERTH); 8 km SE of Kununurra, *K. Paijmans* 2390 (CANB); 29-30 km SW of Gibb River Station, *D.E. Symon* 7066 (ADW, NSW, PERTH); 10 km N of Drysdale Station, *D.E. Symon* 7092 (ADW, PERTH); 25 mi [40 km] SW of Gibb River Homestead, *G.C. Taylor* 49 (MEL, NT).

NORTHERN TERRITORY (selected from c. 20 seen): road from Lawn Hill to Doomadgee Mission, *P. Ollerenshaw* 1339 & *D. Kratzing* (CBG, NT); 7 mi [12 km] SSW of Bing Bong Homestead, *N. Henry* 134 (BRI, NT).

QUEENSLAND (selected from c. 30 seen): Settlement Creek, *L. Brass* 398 (BRI, CANB); 12 mi [19.5 km] N of Esmerelda Station, *N.H. Speck* 4731 (CANB, NSW, NT).

Distribution. (Figures 79, 82.) Confined (in Western Australia) to the Northern Botanical Province, extending from the Mitchell Plateau and Kalumburu Mission to Durack River and Burt Range. Also occurs in Northern Territory and Queensland.

Habitat. Recorded in sandy soils or rarely in clay, sometimes associated with watercourses.

Flowering period. February-August.

Affinities. Closest to *Thecanthes punicea.*

Notes. Specimens from Northern Territory and Queensland tend to have smaller flowers and their involucral bracts green on both surfaces.

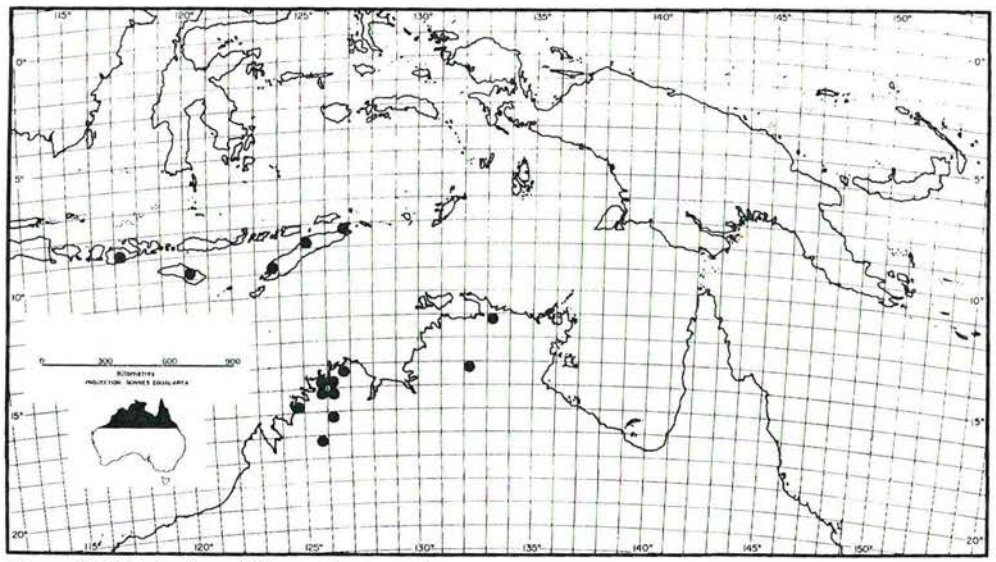

Figure 80. Distribution of *Thecanthes concreta.*

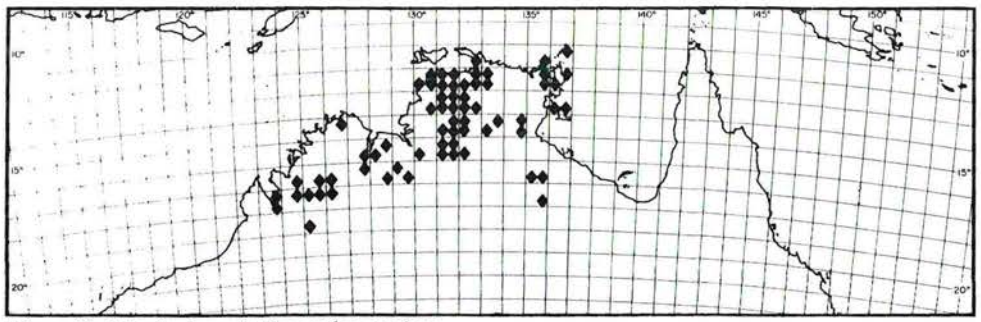

Figure 81. Distribution of *Thecanthes punicea.*

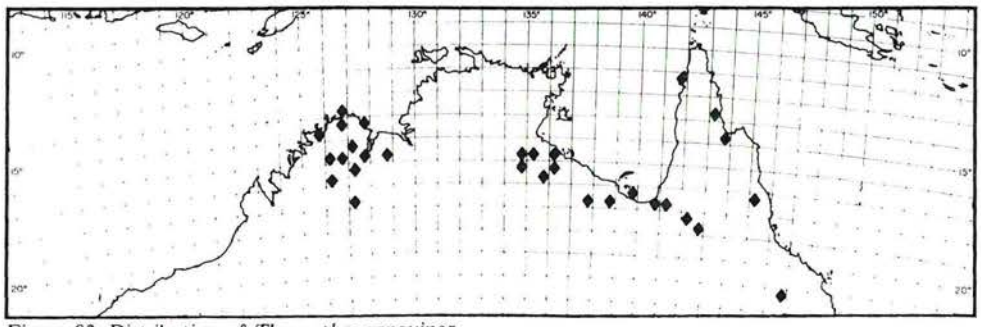

Figure 82. Distribution of *Thecanthes sanguinea.*

Discussion

Genera and Sections. The most significant results of this taxonomic revision have been the reinstatement of *Thecanthes* as a separate genus and the production of a much revised infrageneric classification within *Pimelea*. *Thecanthes* has been reinstated for two reasons. First the absolute differences between it and *Pimelea* sens. strict. are as great or greater than the differences separating many other presently recognised genera of Thymelaeaceae from their closest relatives. Recent taxonomic treatments of extra-Australian Thymelaeaceae, such as that of Tan (1980), have tended to follow the tradition in the family of accepting narrow generic limits. In some cases there is only one or rarely no character giving an absolute separation between a genus and its closest relative. Ding Hou (1960) noted several examples of such genera, including *Wikstroemia,* whose closest relative is the earlier-named genus *Daphne.*

The principal characters distinguishing *Thecanthes* from *Pimelea* are the strongly concave receptacle crowned by bracts and the compressed pedicels. One species of *Pimelea, P. gilgiana*, does have a distinctly concave receptacle but the bracts are inserted near the base of the receptacle rather than at its summit. Two other characteristics of *Thecanthes*, the annual habit and complete or almost complete lack of hairs, are both very rare in *Pimelea* and not found together in any single species of the latter. *Thecanthes* is undoubtedly a very natural group, showing very slight morphological variation in comparison with the much larger genus *Pimelea.*

The second reason for regarding *Thecanthes* as a separate genus is that it shows no clear affinities with any particular section of *Pimelea,* differing from each in at least one obvious character in addition to those separating it from the genus *Pimelea* as a whole. Two of the new sections recognised here, sect. *Macrostegia* and sect. *Heterantheros*, are very distinctive and could be regarded as separate genera. Both are monotypic. Sect. *Macrostegia* is clearly related to some of the species in sect. *Calyptrostegia* and for this reason is not considered to be as distinct as *Thecanthes*. Sect. *Heterantheros* appears to be closest to sect. *Pimelea.*

As can be seen from Table 1, the present infrageneric classification of *Pimelea* differs significantly from the three earlier classifications outlined, even from the recent classification of Threlfall (1983). It does, however, agree with Threlfall in not including *Choristachys* as a subsection under *Calyptrostegia* and in not recognising the other two subsections of *Calyptrostegia* at any level. Rather than accepting the characters used by other authors to define the infrageneric groups, I have first attempted to group species with other species that appeared from their gross morphology to be closely related and then sought characters that could define the groups thus obtained. This has resulted in a more natural classification, in which two eastern Australian species that Threlfall (1983) was unable to assign to any of her sections can now be readily placed.

Threlfall (1983) did not examine species endemic to Western Australia, Northern Territory, Tasmania and overseas; hence she was unable to reassess the infrageneric classification of the genus as a whole. The principal changes made in the present classification, namely the synonymising of several sections and the recognition of three additional sections, have been prompted partly by the consideration of species from the areas not included in Threlfall's study. Indeed, two of the additional sections are based entirely on Western Australian species. When all the Australian species are taken into consideration, there do not appear to be any suitable discontinuities between some of the sections as defined in the earlier classifications. Extra-Australian species were not examined in detail in this study. These species need to be re-examined to determine whether or not they should all be regarded as members of sect. *Pimelea* as was concluded here. The four larger sections, *Pimelea, Epallage, Calyptrostegia* and *Heterolaena*, are not nearly as easily defined as the three small sections of *Pimelea.*

Phylogeny. In comparison with other members of the family, subtribe Pimeleinae, consisting of the two genera *Pimelea* and *Thecanthes*, has an advanced floral structure. It has a well developed floral tube and the most reduced number of floral parts in the family, with four sepals, no corolla lobes, two or one stamens and one functional loculus to the ovary.

Thecanthes is regarded here as being a more advanced genus than *Pimelea* partly because of its annual habit and partly because of its specialised inflorescence. Annual habit is rare in the family and appears to be a derived condition. The compressed pedicels and concave receptacle of *Thecanthes* are both rare, if not completely unknown, in genera of Thymelaeaceae not occurring in Western Australia.

Sect. *Calyptrostegia* appears to have rather close to very close ties with each of the other sections apart from the monotypic sect. *Heterantheros.* It has rather generalised characters, having none of the apparently specialised characters listed for other sections in Table 2. These observations suggest that sect. *Calyptrostegia* may have characters similar to the ancestral members of its genus and could therefore be regarded as the most primitive group. Some of the unique characters listed in the table are clearly derived, such as the specialisations of sect. *Macrostegia.* Others such as succulent fruits are presumed to be derived because of their relative rarity in the subtribe. Each of the characters listed in the remaining headings of the table is variable in the family as a whole as well as in the Pimeleinae so that the primitive state cannot readily be inferred by comparisons with other Thymelaeaceae. Comparisons within groups of the Pimeleinae suggest that the following characters might be primitive: hermaphroditism, sessile (but possibly otherwise leaf-like) involucral bracts, compact terminal inflorescences, medium to large flowers with the style-portion longer than the ovary-portion, circumscissile floral tubes, exserted styles and stamens with a well developed filament and the slits semi-lateral to lateral after dehiscence. The presence of hairs on the pedicels, floral tube and ovary is probably primitive and, if so, has been almost completely lost in *Thecanthes.*

Future Studies. I hope to be able to obtain further material of the Mt Leake variant of *P. ammocharis* so that this taxon can be formally described. Apart from this, the Western Australian taxa that are probably in greatest need of further study are *Pimelea lehmanniana, P. micrantha, P. brachyphylla* and *P. angustifolia.* Detailed examination of the two variants of *P. lehmanniana* in the field, cross-pollination experiments or studies of other aspects of their biology, such as anatomy and cytology, would provide a much better basis than was obtained from the present study to determine whether these variants should be regarded as distinct species or as subspecies. Similar studies are needed of *P. micrantha* and *P. curviflora* in southern and eastern Australia to determine whether their treatment here as separate species is justified. Such studies, particularly of anatomy and cytology, would provide a means not only of elucidating problems within species or small species complexes but also of reassessing the infrageneric classification presented here.

In addition to the *P. micrantha — P. curviflora* complex, there are several very difficult species groups in central and eastern Australia that would benefit from further study, notably those involving *P. linifolia, P. latifolia* and *Thecanthes punicea.* Northern Territory and Tasmania were outside the scope of both this paper and Threlfall (1983). Even so, only 5 or 6 of the known species of *Pimelea* and *Thecanthes* in Australia have not been covered by one or both papers. Of these taxa, all as yet unnamed, two occur in Northern Territory and the others in eastern mainland Australia. They will be described in my forthcoming treatment of the family Thymelaeaceae for "Flora of Australia".

Nomina Nuda probably applied to Western Australian Taxa

Aschenfeldtia pimeleoides F. Muell. ex Meissner, Linnaea 26: 350 (1854), pro syn. sub *Pimelea microcephala.*

Pimelea affinis Loudon, Suppl. Hort. Brit. 3: 609 (1850).

Pimelea baxteri Cunn. ex Meissner in DC., Prodr. 14: 507 (1857), pro syn. sub *P. imbricata* var. *baxteri.*

Pimelea diosmaefolia Lodd., Bot. Cab. 18, t. 1708 (1831). Bentham (1873) listed this, as *Pimelea "diosmifolia* Lodd.", under *Pimelea ferruginea.* The illustration resembles *P. ferruginea* but does not give sufficient detail for a definite identification.

Pimelea distinctissima F. Muell., First Gen. Rep. 17 (1853). Meissner (loc. cit.- 1854, 1857) and Bentham (1873) listed this taxon under *Pimelea microcephala.*

Pimelea linariifolia Cunn. ex Meissner in DC., Prodr. 14: 515 (1857), pro syn. sub *P. microcephala* var. *linariifolia.*

Pimelea neypergiana Hort. ex Decne., Rev. Hort. Ser. 4: 1 (1852), pro syn. sub *P. preissii.* Apparently a misspelling of *P. nieppergiana.*

Pimelea pilibunda Cunn. ex Benth., Fl. Austral. 6: 21 (1873). Bentham (1873) listed this under *Pimelea imbricata* var. *piligera.*

Nomina Dubia

Pimelea brevifolia var. *membranacea* Benth., Fl. Austral. 6: 12 (1873). *Type:* south-western Australia, date unknown, *J. Drummond.* Type not located at K.

Pimelea crinita Lindley, Edward's Bot. Reg. 24: Misc. Notices 59 (1838). — *Pimelea imbricata* var. *crinita* (Lindley) Domin, Vestn. Kral. Ceske. Spolecn. Nauk. Tr. Mat.-Prir. 76-77 (1923). A possible type in K, labelled "Swan River, Lindley 1838", is matched by the description. This specimen is referable to *Pimelea imbricata* var. *piligera.*

Pimelea decussata var. *diosmaefolia* Lodd. ex Meissner in DC., Prodr. 14: 502 (1857). No type located on G-DC microfiche. See notes under *Pimelea diosmaefolia* in nomina nuda.

Pimelea decussata var. *flore-rubro* ?Lemaire ex Jacques, Ann. Fl. Pomone 1837-38: 342 (1838). Based on cultivated material, with no type cited. The description is inadequate to identify the taxon and there is no illustration.

Pimelea decussata var. *requierana* ?Lemaire ex Jacques, Ann. Fl. Pomone 1841-42: 98 (1842). Type as for previous taxon.

Pimelea hendersonii Graham, Edinburgh New Philos. J. 26: 197 (1838). — *Heterolaena hendersonii* (Graham) C. Meyer, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 73 (1845). — *Pimelea rosea* var. *hendersonii* (Graham) Meissner in DC., Prodr. 14: 503 (1857). No type has been located for this and other taxa of *Pimelea* described by Graham (Lauener & Paul 1985: 590). There is no illustration but the description appears to match *P. rosea.*

Pimelea intermedia hort. ex Graham, nom. illegit., Edinburgh New Philos. J. 26: 421 (1839). See note under *P. hendersonii.* There is no illustration. Listed in Index Kewensis 1895 as a synonym of *Pimelea sylvestris* but this is not possible because the description indicates that the floral tube is hairy outside where *P. sylvestris* is glabrous.

Pimelea lehmanniana var. *meiocephala* Diels in Diels & E. Pritzel, Bot. Jahrb. Syst. 35: 392 (1904). *Syntypes:* near Cranbrook, Sept., *Diels* 4476; near Mount Barker, Oct., *Diels* 4978. Both syntypes at B apparently destroyed, no duplicates located.

Pimelea macrocephala Hook., Bot. Mag. 76, t. 4543 (1850). — *Calyptrostegia macrocephala* (Hook.) Walp., Annales Botanices Systematicae 3: 324 (1852). *Type:* Illustration — t. 4543. See notes under *Pimelea drummondii* and *P. floribunda.*

Pimelea menkeana var. *dubia* Meissner in DC., Prodr. 14: 503 (1857). *Type:* south-western Australia, *J. Drummond* 427. No type was located at K, KW, LD, NY or on the G-DC microfiche. There is no illustration and the description is insufficient to place this taxon but it is probably one of the subspecies of *Pimelea suaveolens.*

Pimelea microcephala var. *lanceolata* Meissner in DC., Prodr. 14: 515 (1857). *Type:* near Port Jackson, New South Wales, date unknown, *C. Fraser* (syn: n.v., not found in G-DC microfiche); near Port Jackson, New South Wales, *C. Gaudichaud-Beaupre* (syn: G-DC, n.v., microfiche seen). The specimen seen on the microfiche did not seem sufficiently distinct to identify this taxon although it may well be referable to *P. microcephala* subsp. *microcephala,* under which it is listed by Threlfall (1983: 162).

Pimelea nana Graham, Edinburgh New Philos. J. 29: 174 (1840). — *Calyptrostegia nana* (Graham) Endl., Gen. Pl. Suppl. 4: 61 (1848). — *Pimelea imbricata* var. *nana* (Graham) C.H. Ostendfeld, Contributions to West Australian Botany 3: 93 (1921). See note under *P. hendersonii.* There is no illustration but the description appears to match *Pimelea imbricata* var. *piligera.*

Pimelea nana var. *glabrifolia* Meissner in DC., Prodr. 14: 508 (1857). *Type:* south-western Australia, *J. Drummond* coll. 3, n. 236 ex parte (holo: G-DC, n.v., microfiche seen). This is probably a variant of *Pimelea imbricata* but the microfiche is not clear enough for a definite identification.

Pimelea nieppergiana hort. ex Decne, Rev. Hort. 440 (1881). The description appears to match *P. brevistyla* or *P. longiflora* or possibly *P. preissii*. This taxon was probably described earlier, but presumably misspelt, as *P. weippugiana*.

Pimelea preissii var. *gilbertii* Meissner in DC., Prodr. 14: 500 (1857). *Type:* Western Australia, date unknown, *Gilbert*. Type not located on G-DC microfiche.

Pimelea spectabilis var. *distans* Benth., Fl. Austral. 6: 9 (1873). *Type:* King George Sound, Western Australia, date unknown, *McLean*. Type not located at K and there is no illustration.

Pimelea sulphurea var. *macrocephala* Benth., Fl. Austral. 6: 14 (1873). *Type:* Blackwood River, Western Australia, date unknown, *A.F. Oldfield*. Type not located at K.

Pimelea verschaffeltii Morren, Ann. Soc. Roy. Agric. Gand. 3: 451, t. 166 (1847). — *Pimelea spectabilis* var. *verschaffeltii* (Morren) Meissner in DC., Prodr. 14: 504 (1857). *Type:* Illustration — t. 166. The type specimen was not located at LG and, since the description is based on cultivated material, is assumed not to exist. The illustration and description are inadequate for identification. Listed by Meissner (1857) and Bentham (1873) under *P. spectabilis*.

Pimelea weippugiana Paxton, Paxton's Mag. Bot. 15: 191 (1849). The description given, which is based on cultivated material, is inadequate to identify the species and there is no illustration. This is probably the same species as *P. nieppergiana*, the horticultural name misspelt here.

Acknowledgements

I am very grateful to Professor K.H. Rechinger for providing the Latin diagnoses, Miss S.H. Bird for the illustrations, Mr N. Cohen and Miss A.J.G. Wilson for technical assistance and members of the technical and professional staff of the Western Australian Herbarium, including Dr J.W. Green for comments on a draft of the manuscript. I particularly appreciate the time spent by Mr P.G. Wilson checking the nomenclature and setting out of this paper. I am also indebted to staff of the following herbaria for the loan of specimens: AD, ADW, BM, BRI, CANB, CBG, CGE, DNA, K, LD, MEL, NSW, NT, NY and UWA. This research was partially funded by two grants from the Australian Biological Resources Study.

References

Beard, J.S. (1970). "West Australian Plants." 2nd edn. (Society for Growing Australian Plants.)
Beard, J.S. (1980). A new phytogeographic map of Western Australia. Western Australian Herbarium Research Notes 3: 37-58.
Bentham, G. (1873). "Flora Australiensis." Vol 6. (Lovell, Reeve & Co.: London.)
Brown, R. (1810). "Prodromus florae Novae Hollandiae et insulae Van-Dieman." (Johnson & Co.: London.)
Bunniger, L. (1972). Untersuchungen uber die morphologische Natur des Hypanthiums bei Myrtales- und Thymelaeales-Familien II. Myrtaceae. III. Vergleich mit den Thymelaeaceae. Beitr. Biol. Pflanzen 48: 79-156.
Burrows, C.J. (1960). Studies in *Pimelea*. I. The breeding system. Trans. Roy. Soc. New Zealand 88: 29-45.
Cruikshank, R.H. (1953). Chromosome numbers in the genus *Pimelea*. Pap. & Proc. Roy. Soc. Tasmania 87: 13-16.
Diels, L. & Pritzel, E. (1904). Thymelaeaceae. Fragmenta Phytographiae Australiae Occidentalis. Bot. Jahrb. Syst. 35: 391-397.
Ding Hou, H. (1960). Thymelaeaceae. In "Flora Malesiana." Ser. I, 6: 1-48.
Domke, W. (1934). Untersuchungen uber die systematische und geographische Gliederung der Thymelaeaceen. Biblioth. Bot. 27, 111: 1-151.
Elaise, S. (1959). Contribution a l'etude caryologique et palynologique de quelques Thymeleaceae. Rev. Gen. Bot. 66: 110-161.
Endlicher, S.L. (1837). "Genera Plantarum." Part 4. (Beck: Vienna.)
Endlicher, S.L. (1848). "Genera Plantarum." Suppl. 4. (Beck: Vienna.)
Erickson, R., George, A.S., Marchant, N.G. & Morcombe, M.K. (1979). "Flowers and Plants of Western Australia." (Reed: Sydney.)
Everist, S.L. (1981). "Poisonous Plants of Australia." 2nd edn. (Angus & Robertson: Sydney.)
Fedorov, A. ed. (1969). "Chromosome Numbers of Flowering Plants." (V.L. Komarov Botanical Inst.)
Feeken, E.H.J., Feeken, G.E.E. & Spate, O.H.K. (1970). "The Discovery and Exploration of Australia." (Nelson: Melbourne.)
Fischer, F.E.L. & Meyer, C.A. (1845). "Index Decimus Seminum, quae Hortus Botanicus Imperialis Petropolitanus pro mutua Commutatione offert." (St Petersburg.)
Gardner, C.A. (1930-31). "Enumeratio Plantarum Australiae Occidentalis." (Government Printer: Perth.)
Gilg, E. (1894). Thymelaeaceae. In A. Engler & K. Prantl (eds), "Die Naturlichen Pflanzenfamilien." III, 6a: 216-245.
Green, J.W. (1981). "Census of the Vascular Plants of Western Australia." (Western Australian Herbarium: Perth.)
Heinig, K. (1951). Studies in the floral morphology of the Thymelaeaceae. Amer. J. Bot. 38: 113-132.

Keighery, G.J. (1975). Parallel evolution of floral structures in *Darwinia* (Myrtaceae) and *Pimelea* (Thymeaeaceae). W. Australian Naturalist 13: 45-50.
Kuntze, O. (1891). "Revisio Generum Plantarum." (Dulau & Co.: London.)
Kuntze, O. (1903). In T. Post & O. Kuntze. "Lexicon Generum Phanerogamarum." (Verlags-Anstat: Stuttgart.)
Lauener, L.A. & Paul, H. (1985). The type specimens of Robert Graham. Notes Roy. Bot. Gard. Edinburgh 42: 567-593.
Linnaeus, C. von (filius). (1782). "Supplementum Plantarum." (Brunsvigae.)
Mark, A.F. & Adams, N.M. (1973). "New Zealand Alpine Plants." (Reed: Wellington.)
Meissner, C.F. (1857). Thymelaeaceae. In A. DeCandolle, "Prodromus Systematis Naturalis Regni Vegetabilis." 14: 493-605.
Meyer, C.A. (1845). 4. Einige Bemerkungen uber die Guttung *Pimelea* Banks. Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 4: 71-74.
Moore, L.B. & Irwin, J.B. (1978). "The Oxford Book of New Zealand Plants." (Oxford University Press: Wellington.)
Nelson, E.C. (1974). The locations of collection and collectors of specimens described by Labillardiere in "Novae Hollandiae Plantarum Specimen" - additional notes. Pap. & Proc. Roy. Soc. Tasmania 108: 159-170.
Rattenbury, J.A. (1957). Chromosome Numbers in New Zealand Angiosperms. Trans. Roy. Soc. New Zealand 84: 936-938.
Rye, B.L. (1985). Four new names for *Pimelea* species (Thymelaeaceae) represented in the Perth Region. Nuytsia 5: 1-11.
Sprague, T.A. (1940). Additional nomina generica conservanda (Pteridophyta and Phanerogamae). Bull. Misc. Inform. 1940: 81-134.
Tan, K. (1980). Studies in the Thymelaeaceae II. A revision of the genus *Thymelaea*. Notes Roy. Bot. Gard. Edinburgh 38: 189-246.
Threlfall, S. (1983). The genus *Pimelea* (Thymelaeaceae) in eastern mainland Australia. Brunonia 5: 113-201.
Turczaninow, N. (1852). Decas septima generum adhuc non descriptorum adjectus descriptionibus nonnullarum specierum. Bull. Soc. Imp. Naturalistes Moscou 25/2: 138-181.
Wikstrom, J.E. (1818). Granskning af de till Thymelaerum vaxtordning horande slagten och arter. Kongl. Vetensk. Acad. Handl. 263-285 et seq.

Index to Thymelaeaceae

All names regarded as synonyms are given in italics and taxa not occurring in Western Australia are indicated by an asterisk. Page numbers for the start of the main treatments are in bold, those for figures in roman and those for incidental references in italics. Infrageneric categories above the species level are listed separately before the species and infraspecific taxa of the same genus. Many authors used numbers or letters for the infrageneric categories rather than specifying rank; in these cases the taxa are ordered here according to the letters or numbers rather than by placing the names in alphabetical order.

Publication date of Nuytsia Volume 6, Number 1: 23 December 1987

58831/3/88-750-L/4502 GARRY L. DUFFIELD, Government Printer, Western Australia